CITY OF BALTIMORE
DEPARTMENT OF PUBLIC WORKS
BUREAU OF WATER AND WASTEWATER
SURFACE WATER MANAGEMENT DIVISION

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Preface

This report describes the City of Baltimore's activities from January 1, 2011, through June 30, 2012, in association with its National Pollutant Discharge Elimination System municipal separate storm sewer system discharge permit (Permit Number: MD0068292).

Table of Contents

List of Files on CD-ROM Accompanying Report

2011 Jan 2012 Jun Report for City of Baltimore MS4 Permit.pdf

This is a copy of this report in an Acrobat file.

2011 Jan 2012 Jun BMP As-Built Drawings folder

This is a folder containing 12 Acrobat files. Each file contains the scanned images from one set of as-built drawings from twelve BMPs listed in Table D1a.1. These as-built drawings were received by SWMD between January 2011 and June 2012 and approved by SWMD after field verification. This folder is discussed in Section D1a.

2011 Jan 2012 Jun Urban BMP Mgt Practices.xlsx

This is an Excel file with records for the plans approved during January 2011 through June 2012 which included constructing BMP facilities. This file is discussed in Section D1a.

2011 Jan 2012 Jun Erosion & Sediment Control Violation Notices & Stop Work Orders.pdf

This is an Acrobat file containing scanned images of the 6 violation notices and 7 stop work orders issued by SWMD erosion and sediment control inspectors from January 1, 2011, through June 30, 2012. This file is discussed in Section D2.

Baltimore City NPDES Stormwater Permit Data Jan 2011 to Jun 2012.mdb

Baltimore City Responsible Personnel CertificationJan2011Jun2012

This is an Access table with information on the people who attended this training from January 1, 2011, through June 30, 2012, that is referred to in Section D2a.

Baltimore City Monitoring Sample Results Jan 2011 Jun 2012

This is an Access table with the sample results from January 1, 2011, through June 30, 2012, including: stream impact sampling (SIS); ammonia screening (AS); baseline and discrete stormwater samples from Moores Run monitoring at Hamilton Avenue and Radecke Avenue stations; and restoration monitoring for Stony Run and Powder Mill Run. This table is referred to in Sections D3a, F2 and G1a.

Baltimore City Chemical Monitoring Jan 2011 Jun 2012

This is an Access table that contains the results for stormwater EMCs and baseline discrete samples collected from January 1, 2011, through June 30, 2012, for monitoring in Moores Run at the Hamilton Avenue and Radecke Avenue stations; and restoration monitoring for Stony Run and Powder Mill Run. It is referred to in Sections D3a, F2 and G1a.

January 2011 June 2012 NPDES Construction General Perm.xlsx

This is an Excel file with the records of plans which had a planned earth disturbance greater than one acre which were approved from January2011 through June 2012. This file is discussed in Section D2b.

***City Streams Dry Weather Time Concentration Graphs* folder**

This is a folder that contains 18 Excel files: each file has a set of concentration over time scatterplots for each of the 35 monitoring stations for a given parameter. These graphs have been updated since the set that was sent with the 2010 Annual Report to include sample results through June 2013 (note that extends beyond the time frame of this report). These graphs are referred to in Sections D3a, F2, and G1a.

Macroinvertebrate Sample Results 2002 through 2012.xls

This is an Excel file that contains a record for each one of the 325 macroinvertebrate samples collected at fixed and random sites from 2002 through 2012. Each record has the benthic IBI score calculated for the sample using the method endorsed by the Maryland Biological Stream Survey (MBSS) in their October 2005 report, "New Biological Indicators to Better Assess the Condition of Maryland Streams". These samples are discussed in Sections E3, F2 and G1b.

Hamilton & Radecke Stm EMC Time Graphs.xls

This is an Excel file that contains the storm event mean concentrations (EMCs) over time scatterplots for Hamilton Avenue and Radecke Avenue. These graphs have been updated since the set that was sent with the 2010 Annual Report to include storm EMCs through the storm on September 18, 2012. These graphs are referred to in Section G1a.

A. Permit Administration

Kimberly Burgess, Chief of the Surface Water Management Division (SWMD), continues as the liaison with the Maryland Department of the Environment (MDE). Ms. Burgess' address is 200 N. Holliday Street Room 307, Baltimore, MD 21202. Her phone number is (410) 396-4700. Her e-mail address is Kimberly.Burgess@baltimorecity.gov.

Other changes in the management of City agencies that have responsibilities for programs related to stormwater pollution control are:

- The Director of the Department of Transportation is now William M. Johnson.
- The Director of the Department of General Services is now Steve Sharkey.

B. Legal Authority

The City maintained adequate legal authority in accordance with NPDES regulations 40 CFR 122.26(d)(2)(i) during the period of this report (January 1, 2011 through June 30, 2012).

C. Source Identification- GIS Data

1. **Storm Drain System**
   An updated set of GIS files will be submitted with the report for Fiscal Year 2013.

2. **Urban Best Management Practices (BMP)**
   SWMD has not yet built a database system to manage records of existing BMPs, and have a place where records can be created as new BMPs are approved and then built. SWMD does not yet have an estimate of the date this database will be ready.

3. **Impervious Surfaces**
   An updated set of GIS files will be submitted with the report for Fiscal Year 2013.

4. **Monitoring Locations**
   An updated set of GIS files will be submitted with the report for Fiscal Year 2013.

5. **Watershed Restoration**
   An updated set of GIS files will be submitted with the report for Fiscal Year 2013.

D. Management Programs

1. **Stormwater Management**

SWMD has the responsibility to maintain programmatic and implementation information. From January 1, 2011, through June 30, 2012, there were 318 projects that were exempted from stormwater management based on project size (less than 5,000 square feet of disturbed area); and there were 160 development projects that received final approval for erosion and sediment control and/or stormwater management compliance with Article 7 of the City Code. Four of these 160 projects involved modifications to plans that had been approved prior to January 1, 2011. The 160 plan approvals would allow for an approximate total of 424 acres of land disturbance.

There were 65 projects for which the plans had a disturbed area of more than 1 acre, and thus would require an NPDES General Construction Permit from MDE.

There were 49 projects for which the plans had the installation of a best management practice (BMP). Taken together the BMPs, if built, for these 49 projects would have qualitative control for approximately 61 acres of impervious area.

If all 160 projects were constructed as planned, the anticipated reduction of impervious area would be approximately 12 acres.

There were 102 projects which received waivers or variance:

- 42 redevelopments;
- 10 quantitative;
- 48 qualitative
- 3 administrative;
- 8 phased; and
- 1 variance.

There were 16 projects which were allowed to meet the associated stormwater management development requirements by using a fee-in-lieu, resulting in a total of $529,875.28 in collected fees. The total of fees collected breaks down as:

- $462,275.03 for water quality for 14 projects;
- $55,082.25 for Cpv for 4 projects;
- $7,193.00 for Q10 for 3 projects; and
- $5,325.00 for Q100 for 3 projects.

a. **New BMPs**
SWMD received as-built drawings for 12 stormwater management BMPs from January 1, 2011 through June 30, 2012. Table D1a.1 lists the 12 projects with the date that SWMD released the bond for the project.

Table D1a.1 As-Builts Submitted & Approved January 2011 through June 2012		
Tracking Number	**Project Name**	**Bond Release Date**
ESD 5480	Wyndholme Woods	2/9/2011
ESD 5541	Zeta Senior Center	3/31/2011
ESD 6015	Fells Point Wholesale Meats	4/29/2011
ESD 5235	Enoch Pratt Free Library Orlean Branch	6/28/2011
ESD 5659	Light Street Garage	11/9/2011
ESD 5867	Our Lady of Fatima Senior Housing	12/15/2011
ESD 5952	Our Lady of Fatima Senior Housing II	12/15/2011
ESD 4480	Ashman's Hope	12/16/2011
ESD 5964	MVA Hilltop Shopping Center	12/30/2011
ESD 5571	BGE Paca Street Substation	1/19/2012
ESD 5537	BGE Orchard Street Substation	1/19/2012
ESD 5487	Benhurst Overlook	4/2/2012

These 12 sets of as-built drawings were scanned into files, which can be found in the folder "2011 Jan 2012 Jun BMP As-Built Drawings" on the CD-ROM accompanying this report.

SWMD approved plans containing 49 BMPs for construction from January 1, 2011 through June 30, 2012. A summary table of these 49 BMPs is provided in the in the Excel file "2011 Jan 2012 Jun Urban BMP Mgt Practices.xlsx" on the CD-ROM accompanying this report.

b. **Maintenance Inspections**

SWMD conducted 160 BMP maintenance inspections of 128 facilities from January 1, 2011 through June 30, 2012. There were 48 facilities that were found in compliance, and 80 facilities identified as needing correction. SWMD notified the owners of 21 out of 80 facilities that their facilities needed correction. There were 17 out of these 21 facilities where the owners made the necessary corrections. There were no fines imposed.

2. **Erosion and Sediment Control**

SWMD has the responsibility for the erosion and sediment control program. During the period January 1, 2011 through June 30, 2012, SWMD employed four sediment and erosion control inspectors and one supervisor to routinely inspect all construction activities, as mandated in Article 7, Division II of the City Code.

From January 1, 2011 through June 30, 2012, the City's erosion and sediment control inspectors issued 9 violation notices, which included 5 stop work orders. They issued 8 fines for a total of $8,100. Copies of these documents can be found in the Acrobat file "2011 Jan 2012 Jun Erosion & Sediment Control Violation Notices & Stop Work Orders.pdf" on the CD-ROM accompanying this report.

a. **Responsible Personnel**
SWMD conducted five (5) "responsible personnel" certification classes within this reporting period, on the following dates:

- May 6, 2011;
- October 18, 2011;
- January 25, 2012;
- March 16, 2012; and
- May 11, 2012.

The first class was taught by Tracy Moffatt; and the other four classes were taught by Albert Barnes. A total of 123 people received "green cards" after passing the exams administered during these five classes. Information on those who were certified can be found in table "Baltimore City Responsible Personnel CertificationJan2011Jun2012" in the Access database "Baltimore City NPDES Stormwater Permit Data Jan 2011 to Jun 2012.mdb" on the CD-ROM accompanying this report.

b. **Grading (Earth Disturbances) Permits**
From January 2011 through June 2012, SWMD approved the plans for 65 projects for which the plans had a disturbed area of more than 1 acre, and thus would require an NPDES General Construction Permit from MDE. A summary table of these 65 projects is provided in the file "January 2011 June 2012 NPDES Construction General Perm.xlsx" on the CD-ROM accompanying this report.

3. **Illicit Discharge**

a. **Pollution Source Tracking (PST)**
SWMD relies on ammonia screening (AS) and stream impact sampling (SIS), two water quality monitoring programs run by the Water Quality Monitoring and Inspection Section, to initiate PSTs. The monitoring results from the surveys for the AS and SIS programs from January 1, 2011 through June 30, 2012, are listed within table "Baltimore City Monitoring Sample Results Jan 2011 Jun 2012" in the Access database "Baltimore City NPDES Stormwater Permit Data Jan 2011 to Jun 2012.mdb" on the CD-ROM accompanying this report. The period of this report (January 1, 2011 through June 30, 2012) spans the second half of Fiscal Year 2011 and all of Fiscal Year 2012. Table D3a.1 lists a breakdown of the number of water quality analyses by watershed and monitoring program for the entire Fiscal Year 2011 (note that this extends six months prior to the period covered by this report). Table D3a.2 lists a breakdown of the number of water quality analyses by watershed and monitoring program for Fiscal Year 2012.

Table D3a.1 Monitoring Associated with Illicit Discharge Detection During Fiscal Year 2011 (7/1/2010 to 6/30/2011)			
Program	Number of Surveys	Number of Stations Visited (Samples Taken)	Number of Water Quality Analyses Performed
Back River Watershed SIS	10	110	1,953
Baltimore Harbor Watershed SIS	12	84	1,651
Gwynns Falls Watershed SIS	12	108	1,923
Jones Falls Watershed SIS	12	60	976
Patapsco River Watershed SIS	12	12	230
Quality Control Replicates	46	46	599
Quality Control Blanks for Harbor SIS Enterococci	12	12	12
Back River Watershed Ammonia Screening	22	302	1,811
Baltimore Harbor Watershed Ammonia Screening	37	257	1,552
Gwynns Falls Watershed Ammonia Screening	21	258	1,440
Jones Falls Watershed Ammonia Screening	24	276	1,663
Patapsco River Watershed Ammonia Screening	36	36	218
Quality Control Replicates for Harbor Ammonia Screening Enterococci	12	12	12
Quality Control Blanks for Harbor Ammonia Screening Enterococci	11	11	11
Total	198	1,503	14,051

Table D3a.2 Monitoring Associated with Illicit Discharge Detection During Fiscal Year 2012 (7/1/2011 to 6/30/2012)			
Program	Number of Surveys	Number of Stations Visited (Samples Taken)	Number of Water Quality Analyses Performed
Back River Watershed SIS	12	132	2,489
Baltimore Harbor Watershed SIS	12	84	1,649
Gwynns Falls Watershed SIS	12	108	1,980
Jones Falls Watershed SIS	12	60	988
Patapsco River Watershed SIS	12	12	230
Quality Control Replicates	48	48	632
Quality Control Blanks for Harbor SIS Enterococci	12	12	12
Back River Watershed Ammonia Screening	32	404	2,340
Baltimore Harbor Watershed Ammonia Screening	30	210	1,314
Gwynns Falls Watershed Ammonia Screening	38	458	2,678
Jones Falls Watershed Ammonia Screening	35	391	2,293
Patapsco River Watershed Ammonia Screening	30	30	187
Quality Control Replicates for Harbor Ammonia Screening Enterococci	10	10	10
Quality Control Blanks for Harbor Ammonia Screening Enterococci	10	10	10
Total	225	1,889	16,812

The dates for surveys in each watershed from January 1, 2011, through June 30, 2012, are listed in Table D3a.3.

Table D3a.3 Dates for Ammonia Screening (AS) and Stream Impact Sampling Surveys (SIS) January 2011 through June 2012 in Each Watershed

Back River		Jones Falls		Gwynns Falls		Baltimore Harbor & Patapsco River	
Date	**Type**	**Date**	**Type**	**Date**	**Type**	**Date**	**Type**
First Quarter Calendar Year 2011 (Third Quarter Fiscal Year 2011)							
1/19/2011	AS	1/6/2011	AS	1/7/2011	AS	1/5/2011	AS+E
2/3/2011	AS	1/10/2011	SIS	1/11/2011	AS	1/11/2011	AS
2/10/2011	AS	1/20/2011	AS	1/24/2011	SIS	1/19/2011	SIS
2/17/2011	AS	2/7/2011	SIS	2/4/2011	AS	1/25/2011	AS
3/1/2011	SIS	2/15/2011	AS	2/8/2011	AS	2/4/2011	AS
3/11/2011	AS	3/2/2011	AS	2/14/2011	SIS	2/8/2011	AS+E
3/17/2011	AS	3/7/2011	SIS	3/3/2011	AS	2/16/2011	AS
3/24/2011	AS	3/15/2011	AS	3/9/2011	AS	2/23/2011	AS
3/28/2011	SIS	3/24/2011	AS	3/16/2011	AS	2/24/2011	SIS
		3/29/2011	AS	3/21/2011	SIS	3/2/2011	AS+E
				3/30/2011	AS	3/8/2011	AS
						3/14/2011	SIS
						3/22/2011	AS
						3/31/2011	AS
Second Quarter Calendar Year 2011 (Fourth Quarter Fiscal Year 2011)							
4/7/2011	AS	4/4/2011	SIS	4/6/2011	AS	4/1/2011	AS+E
4/20/2011	AS	4/20/2011	AS	4/18/2011	SIS	4/5/2011	AS
4/27/2011	SIS	5/2/2011	SIS	5/5/2011	AS	4/11/2011	SIS
5/18/2011	AS	5/10/2011	AS	5/9/2011	SIS	4/19/2011	AS
5/23/2011	SIS	5/19/2011	AS	5/26/2011	AS	5/6/2011	AS+E
6/3/2011	AS	5/24/2011	AS	5/31/2011	AS	5/11/2011	AS
6/23/2011	AS	6/1/2011	AS	6/20/2011	SIS	5/16/2011	SIS
6/27/2011	SIS	6/6/2011	SIS			5/27/2011	AS
		6/21/2011	AS			6/3/2011	AS+E
		6/28/2011	AS			6/7/2011	AS
						6/13/2011	SIS
						6/22/2011	AS
						6/23/2011	AS
						6/29/2011	AS
Third Quarter Calendar Year 2011 (First Quarter Fiscal Year 2012)							
7/7/2011	AS	7/6/2011	SIS	7/1/2011	AS	7/5/2011	AS+E
7/8/2011	AS	7/12/2011	AS	7/7/2011	AS	7/11/2011	SIS
7/14/2011	AS	7/19/2011	AS	7/12/2011	AS	7/19/2011	AS
7/25/2011	SIS	7/19/2011	AS	7/18/2011	SIS	7/27/2011	AS
8/3/2011	AS	7/27/2011	AS	7/19/2011	AS	8/2/2011	AS+E
8/11/2011	AS	8/1/2011	SIS	7/26/2011	AS	8/11/2011	AS
8/22/2011	SIS	8/10/2011	AS	8/8/2011	SIS	8/16/2011	SIS
9/2/2011	AS	8/23/2011	AS	8/9/2011	AS	8/24/2011	AS
9/9/2011	AS	8/30/2011	AS	8/10/2011	AS	8/30/2011	AS+E
9/15/2011	AS	9/6/2011	SIS	8/23/2011	AS	9/12/2011	SIS
9/22/2011	AS	9/12/2011	AS	8/30/2011	AS		
9/26/2011	SIS	9/21/2011	AS	9/13/2011	AS		
		9/28/2011	AS	9/19/2011	SIS		
				9/27/2011	AS		

Gray highlight indicates that the survey was done during, or just after, a precipitation event. AS+E means that samples were collected for enterococci MPN counts during the ammonia screening survey.

Table D3a.3 Dates for Ammonia Screening (AS) and Stream Impact Sampling Surveys (SIS) January 2011 through June 2012 in Each Watershed (continued)

Back River		Jones Falls		Gwynns Falls		Baltimore Harbor & Patapsco River	
Date	**Type**	**Date**	**Type**	**Date**	**Type**	**Date**	**Type**
Fourth Quarter Calendar Year 2011 (Second Quarter Fiscal Year 2012)							
10/5/2011	AS	10/3/2011	SIS	10/6/2011	AS	10/7/2011	AS
10/21/2011	AS	10/20/2011	AS	10/12/2011	AS	10/11/2011	SIS
10/24/2011	SIS	10/26/2011	AS	10/17/2011	SIS	10/18/2011	AS
11/3/2011	AS	10/31/2011	SIS	10/26/2011	AS	10/25/2011	AS+E
11/8/2011	AS	11/8/2011	AS	11/1/2011	AS	11/2/2011	AS
11/17/2011	AS	11/15/2011	AS	11/7/2011	SIS	11/9/2011	AS
11/28/2011	SIS	11/21/2011	AS	11/15/2011	AS	11/14/2011	SIS
12/6/2011	AS	11/29/2011	AS	11/30/2011	AS	11/21/2011	AS
12/14/2011	AS	12/5/2011	SIS	12/6/2011	AS	11/29/2011	AS+E
12/19/2011	SIS	12/20/2011	AS	12/12/2011	SIS	12/9/2011	SIS
		12/29/2011	AS			12/16/2011	AS+E
First Quarter Calendar Year 2012 (Third Quarter Fiscal Year 2012)							
1/6/2012	AS	1/4/2012	AS	1/3/2012	AS	1/3/2012	AS
1/12/2012	AS	1/9/2012	SIS	1/11/2012	AS	1/17/2012	SIS
1/24/2012	AS	1/18/2012	AS	1/19/2012	AS	1/25/2012	AS+E
1/30/2012	SIS	1/24/2012	AS	1/23/2012	SIS	2/1/2012	AS
2/7/2012	AS	1/31/2012	AS	2/2/2012	AS	2/10/2012	AS+E
2/15/2012	AS	2/6/2012	SIS	2/7/2012	AS	2/14/2012	AS
2/22/2012	AS	2/14/2012	AS	2/13/2012	SIS	2/21/2012	SIS
2/27/2012	SIS	2/22/2012	AS	2/23/2012	AS	3/2/2012	AS+E
3/7/2012	AS	3/5/2012	SIS	2/28/2012	AS	3/6/2012	AS
3/15/2012	AS	3/14/2012	AS	3/6/2012	AS	3/12/2012	SIS
3/26/2012	SIS	3/27/2012	AS	3/13/2012	AS	3/20/2012	AS
				3/19/2012	SIS	3/29/2012	AS
				3/28/2012	AS		
Second Quarter Calendar Year 2012 (Fourth Quarter Fiscal Year 2012)							
4/12/2012	AS	4/2/2012	SIS	4/3/2012	AS	4/11/2012	AS
4/19/2012	AS	4/10/2012	AS	4/9/2012	SIS	4/16/2012	SIS
4/23/2012	SIS	4/16/2012	AS	4/19/2012	AS	4/25/2012	AS
5/2/2012	AS	4/27/2012	AS	4/24/2012	AS	5/9/2012	AS
5/10/2012	AS	4/30/2012	SIS	5/1/2012	AS	5/16/2012	SIS
5/21/2012	SIS	5/8/2012	AS	5/7/2012	SIS	5/24/2012	AS
6/1/2012	AS	5/17/2012	AS	5/16/2012	AS	6/5/2012	AS+E
6/5/2012	AS	5/22/2012	AS	5/23/2012	AS	6/11/2012	SIS
6/14/2012	AS	5/29/2012	AS	5/31/2012	AS	6/22/2012	AS
6/22/2012	AS	6/4/2012	SIS	6/5/2012	AS		
6/25/2012	SIS	6/13/2012	AS	6/14/2012	AS		
		6/19/2012	AS	6/18/2012	SIS		
				6/28/2012	AS		

Gray highlight indicates that the survey was done during, or just after, a precipitation event. AS+E means that samples were collected for enterococci MPN counts during the ammonia screening survey.

Most PSTs are initiated when field surveys yield unusually high measurements. However, staff also can use the accumulated history of field and lab water quality data for a given station to decide to initiate a PST. On the CD-ROM accompanying this report, there is a folder entitled "City Streams Dry Weather Time Concentration Graphs". This folder contains 18 Excel files: each file has a set of concentration

over time scatterplots for each of the 35 monitoring stations for a given parameter. The parameters graphed are:

- ammonia nitrogen (lab measurement);
- ammonia nitrogen (field measurements- this file has graphs for an additional 14 stations that are only visited during ammonia screening surveys);
- BOD;
- chlorides;
- COD;
- conductivity (measured in the lab);
- total copper;
- e. coli MPN counts;
- enterococcus MPN counts;
- fecal coliform counts;
- fluoride;
- nitrate+nitrite nitrogen;
- sodium (only 4 stations);
- suspended solids;
- TKN;
- total nitrogen (estimated by adding together nitrate+nitrite nitrogen and TKN);
- total phosphorus; and
- total zinc.

Further discussion of these graphs is provided in Section E2, "Watershed Assessment from Chemical Monitoring" of this report.

SWMD initiated 151 PSTs from January 2011 through June 2012. Table D3a.4 lists the breakdown of these 151 PSTs by watershed and the status of the investigation as of August 21, 2013.

Table D3a.4 Pollution Source Tracking Investigations Initiated by SWMD from January 2011 through June 2012

Status of PST	**Back River**	**Baltimore Harbor**	**Gwynns Falls**	**Jones Falls**	**Patapsco River**	**Total**
Resolved	13	15	28	21	1	**78**
Stopped (ex. trail ended, no problem found)	11	12	7	16	1	**47**
Problem found, referred to agency, repairs pending	0	3	3	2	1	**9**
Problem found, referred to agency, not resolved	1	5	2	2	0	**10**
On-going Investigation	0	3	4	0	0	**7**
Total	**25**	**38**	**44**	**41**	**3**	**151**

Waterview Avenue Chromium PST

The Waterview Avenue SIS station has a history of total chromium values that are usually significantly higher than those encountered at other SIS stations. Figure D3a.1 shows the total chromium concentrations for Waterview Avenue over the period of monitoring through June 2012. In the 2005 Annual Report, the City reported on its unsuccessful efforts to find the source of the high total chromium readings at the Waterview Avenue station.

Since then, SWMD has continued to collect monthly samples at the Waterview Avenue SIS station. Since September 2009, SWMD has analyzed each sample from this station for dissolved metals concentrations; previously, only one out of four monthly samples had been analyzed for dissolved metals concentrations. Table D3a.5 lists the total and dissolved metals results for the Waterview Avenue station from January 2011 through June 2012.

Figure D3a.1 Total Chromium Concentrations for Waterview Avenue SIS Station March 28, 2000 through June 11, 2012

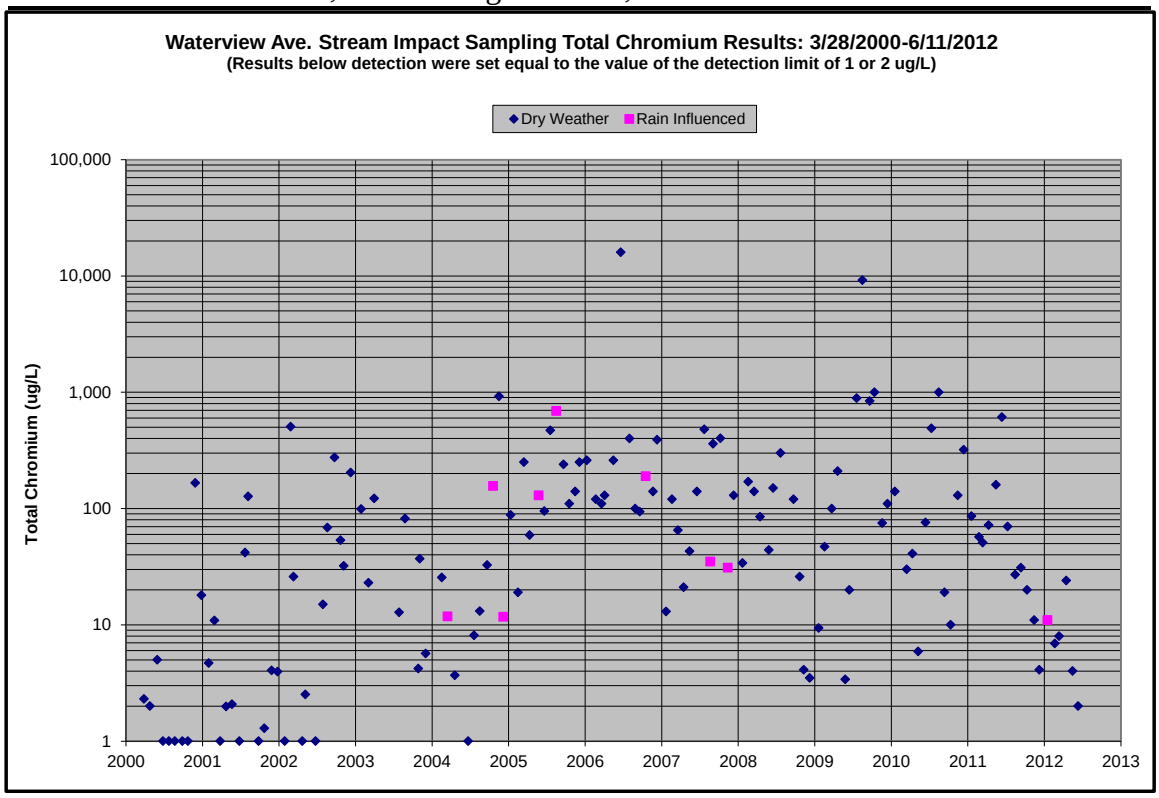


Table D3a.5 Waterview Ave. Metals Results Dry Weather Screening January 2011 through June 2012									
Date	Total Chromium (ug/L)	Dissolved Chromium (ug/L)	Total Copper (ug/L)	Dissolved Copper (ug/L)	Total Lead (ug/L)	Dissolved Lead (ug/L)	Total Zinc (ug/L)	Dissolved Zinc (ug/L)	Total Hardness (mg/L)
1/19/2011	86	3.2	16	6.6	3.6	0.27	71	50	240
2/24/2011	57	2.1	7.1	2.7	1.4	0.14	58	48	240
3/14/2011	51	<2	11	3	5.2	<0.05	64	32	300
4/11/2011	72	<2	26	2.8	4.4	<0.05	76	46	350
5/16/2011	160	<2	41	10	3.2	0.45	69	21	200
6/13/2011	610	4.2	120	3.8	75	1.2	260	20	260
7/11/2011	70	2.1	34	8.5	3.9	0.11	78	26	270
8/16/2011	27	<2	15	3.6	12	<2	80	19	210
9/12/2011	31	6.1	15	6.3	<2	2.6	33	22	240
10/11/2011	20	<2	14	5.4	2.9	<2	77	31	240
11/14/2011	11	<2	5.2	<2	<2	<2	51	26	250
12/9/2011	4.1	<2	5.1	3.2	<2	<2	40	22	220
1/17/2012	11	<2	17	4.4	13	<2	110	46	160
2/21/2012	6.9	<2	3.5	<2	3.6	<2	29	39	230
3/12/2012	8	<2	3	4	1.5	1.3	47	21	240
4/16/2012	24	<2	3	<2	1.2	<0.5	34	43	240
5/16/2012	4	<2	3	<2	1.5	4.4	34	45	220
6/11/2012	<2	<2	<2	<2	0.6	<0.5	23	15	230
Gray highlight indicates that it rained during the survey done that day.									

b. **Exterior Lead Paint Removal Waste Control Program**
This program is administered by the Pollution Control Section of the Environmental Services Division of the Bureau of Water and Wastewater. Table D3b.1 and Figures D3b.1 through D3b.4 show annual statistics from this program for 2001 through 2012.

Table D3b.1 Exterior Lead Paint Removal Waste Control Program Statistics				
Calendar Year	Number of permitted sites	Number of stop work notices	Number of site inspections	Number of documented illegal discharges to the storm drain system
2001	400	106	486	2
2002	459	130	542	2
2003	509	109	545	7
2004	568	87	246	6
2005	724	51	402	10
2006	774	47	254	12
2007	473	32	168	11
2008	234	31	131	2
2009	189	25	120	7
2010	274	18	125	0
2011	274	12	254	0
2012	242	12	272	0

Figure D3b.1 Exterior Lead Paint Removal Waste Control Program Number of Permitted Sites 2001-2012

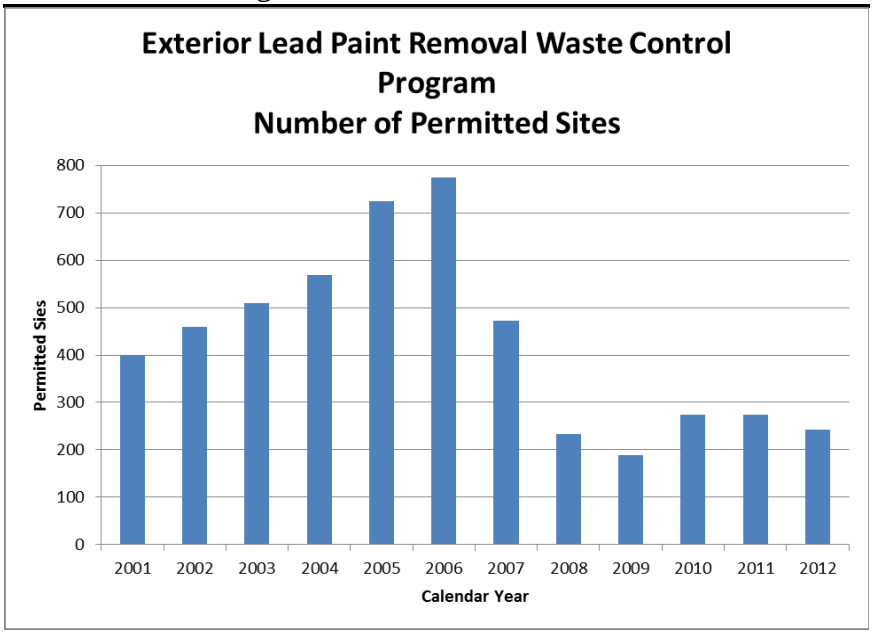


Figure D3b.2 Exterior Lead Paint Removal Waste Control Program Number of Stop Work Orders 2001-2012

Figure D3b.3 Exterior Lead Paint Removal Waste Control Program Number of Site Inspections 2001-2012

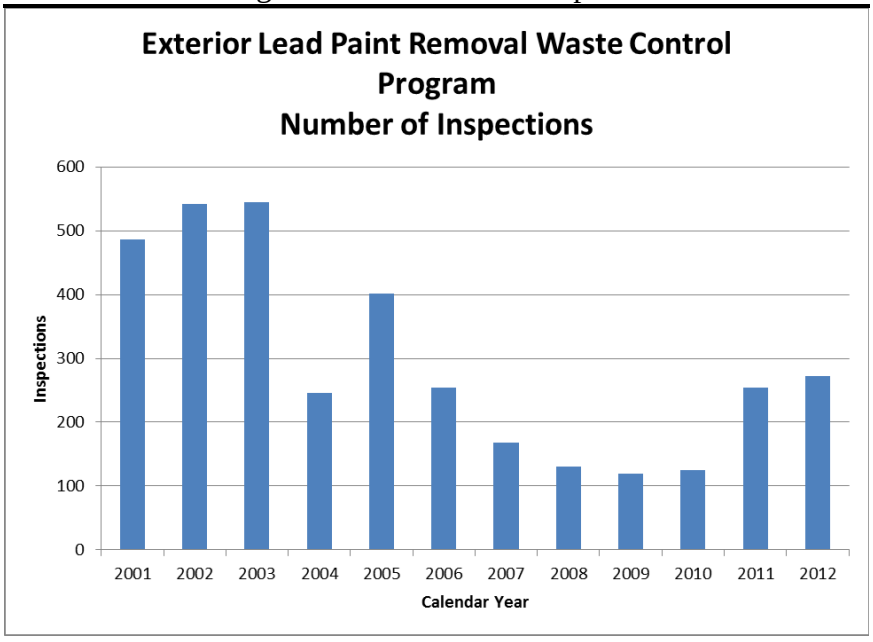
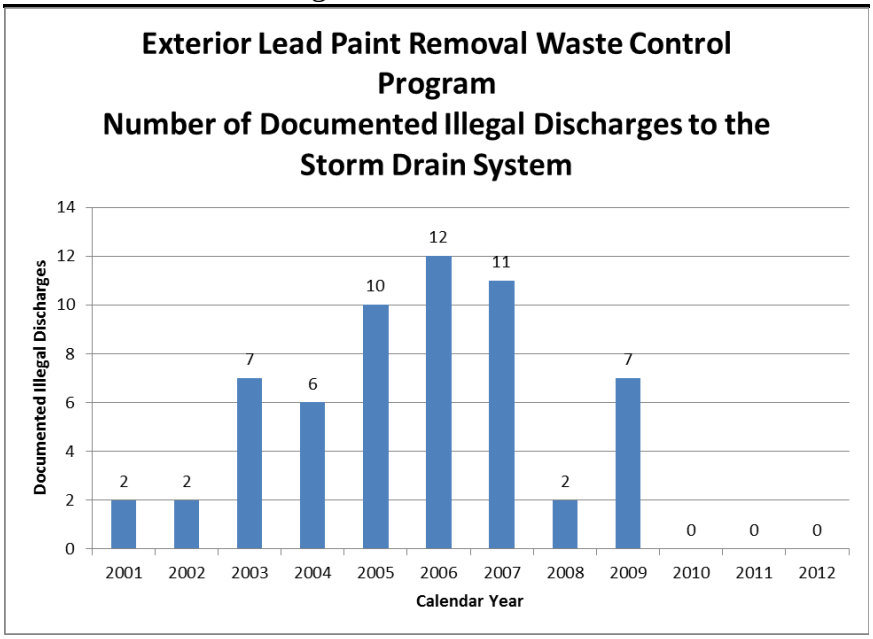


Figure D3b.4 Exterior Lead Paint Removal Waste Control Program Number of Documented Illegal Discharges 2001-2012



4. **City Property Management**

a. **Wastewater Treatment Plants**

The Department of Public Works (DPW), Bureau of Water and Wastewater, Facilities Division is responsible for the Back River Wastewater Treatment Plant and the Patapsco Wastewater Treatment Plant. DPW updated the stormwater pollution prevent plan (SWPPP) for each of these sites and delivered copies to EPA in September 2010.

b. **Landfills**

The Department of Public Works, Bureau of Solid Waste has the responsibility to administer the pollution prevention plans for the City's seven landfills. The Quarantine Road Landfill is the only currently active landfill; the others have been closed

- Reedbird in 1976;
- Cold Spring Lane in 1980;
- Monument Street in 1980;
- Pennington Avenue in 1981; and
- Bowley's Lane in 1985.

During 2010, DPW prepared a comprehensive erosion and sediment control plan to address conditions encountered at both Quarantine Road Landfill and the adjacent Millennium Stockpile. Construction of numerous improvements was completed in 2012.

c. **Sub-stations**

Sub-stations are facilities where City-owned vehicles are maintained and fueled. Road salt is stored at some of the facilities. The Department of General Services (DGS), Fleet Division is responsible for the administration of the stormwater pollution prevention plans (SWPPPs) for the City's sub-stations.

The six facilities listed below (with their respective registration numbers) remain permitted under the General Discharge Permit for Stormwater Associated with Industrial Activities, Permit Number 02-SW. The SWPPPs for each of these facilities were updated in May 2010, and a signed copy of each SWPPP was delivered to MDE in August 2010. No significant updates have been made to these documents. New updates are anticipated with the issuance of the upcoming NPDES permit.

List of Facilities Registered Under the General Discharge Permit 02-SW:

- Midtown Fueling Station – 410 Front St. – 02SW0704
  Main fueling facility for the entire City, open 24 hours. Replenish fluids for vehicles.
- Fallsway Substation – 201 Fallsway – 02SW0707
  Open 16 hours (2 shifts). Provide preventive maintenance services of vehicles located in the downtown area. Conduct moderate repair for vehicles, motorcycle shop, carwash and towing.
- Northeastern Substation – 4325 York Road – 02SW0702
  Open 16 hours (2 shifts). Fueling station, provide moderate repairs on vehicles and houses the Department of Transportations' salt dome and towing.
- Mechanic Shop – 6400 Pulaski Highway – 02SW0708
  Open 8 hours. Repair mowing and complex equipment; towing.
- Western Substation – 239 North Calverton Street – 02SW0703
  Open 16 hours (2 shifts). Provide preventive maintenance for City vehicles, moderate repair and towing.
- Northwestern Substation – 4410 Lewin Avenue – 02SW0705
  Open 16 hours (2 shifts). Fueling station, provide moderate repairs on vehicles and houses the Department of Transportation's salt dome and towing.

d. **Northwest Transfer Station (02SW1307)**

The Department of Public Works, Bureau of Solid Waste is responsible for this facility. The City completed a stormwater pollution prevent plan (SWPPP) for this site in January 2010. No significant updates have been made to these documents.

5. Road Construction and Maintenance

a. Street Sweeping and Storm Drain Cleaning

Street Sweeping

Between January 2011 and June 2012 (18 months), the street sweepers operated by the Bureau of Solid Waste removed 11,234 tons of debris after sweeping 118,558 miles of street surface. Table D5a.1 and Figures D5a.1 and D5a.2 present the number of road miles swept and amount of debris collected by the street sweepers operated by the Bureau of Solid Waste for calendar years 1999 through 2010 and fiscal years 2011 and 2012. Further discussions of the benefit of street sweeping and its relation to the City's impervious area goal are provided under "Street Sweeping and Inlet Cleaning" in Section F3, "Annual Reporting" of this report.

D5a.1 Street Sweeping Statistics

Year	Roads Swept (miles)	Debris Removed (tons)
CY1999	93,600	16,000
CY2000	145,600	16,897
CY2001	102,500	15,569
CY2002	74,400	14,437
CY2003	75,098	11,347
CY2004	42,098	8,686
CY2005	47,050	6,208
CY2006	80,000	7,261
CY2007	82,481	7,800
CY2008	79,075	9,308
CY2009	70,143	8,186
CY2010	63,203	6,783
FY2011	71,731	7,566
FY2012	82,658	7,429

Figure D5a.1 Street Sweeping Miles of Roads Swept

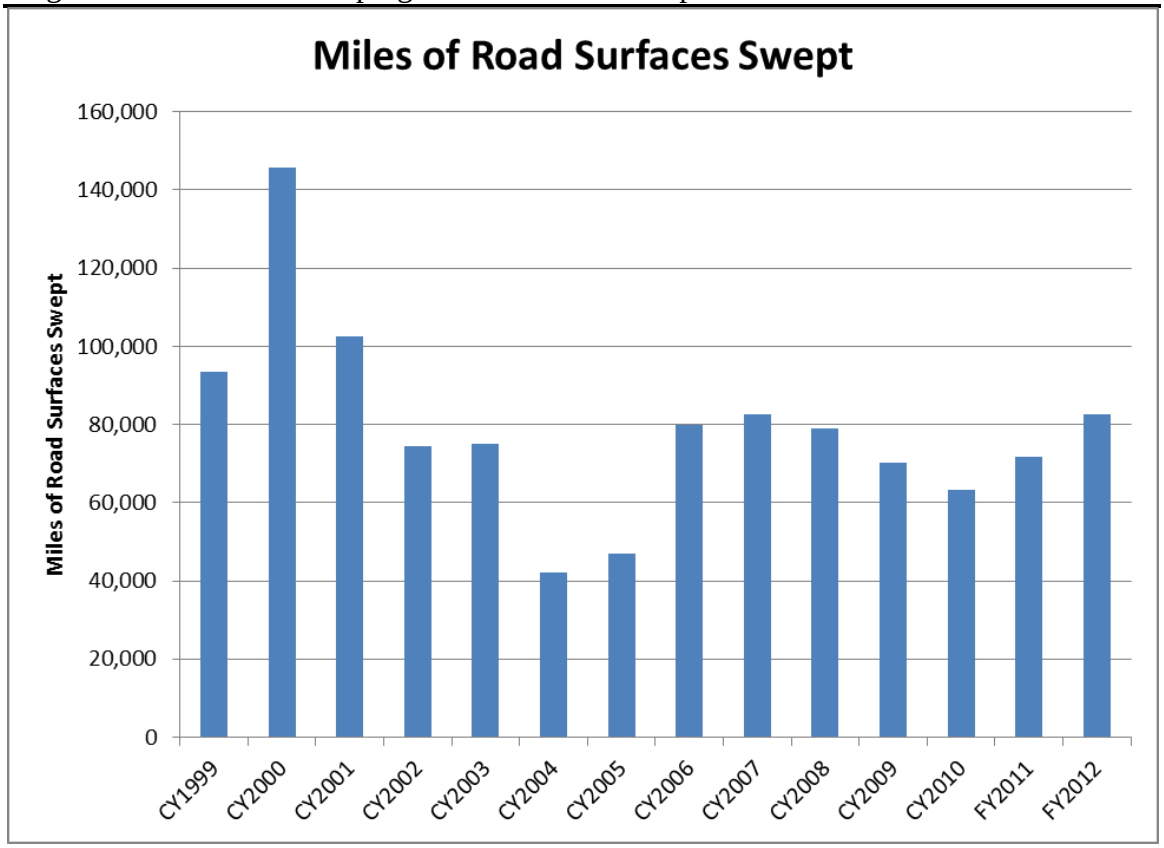
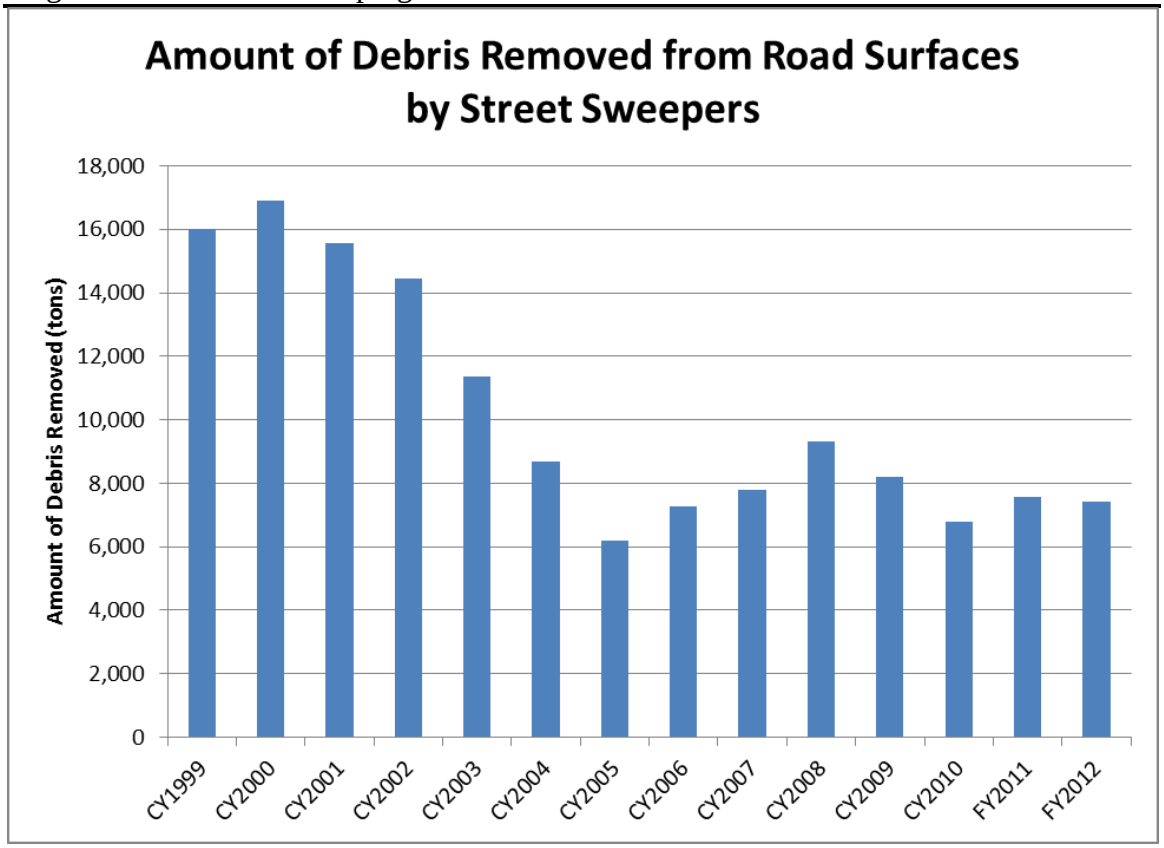


Figure D5a.2 Street Sweeping Tons of Debris Removed



Storm Drain Cleaning

The Utility Maintenance Division (UMD) of the Bureau of Water and Wastewater cleaned 9,222 inlets from January 2011 through December 2012. They cleaned 7,149 inlets in response to complaints of inlet chokes through the 3-1-1 system. The remaining 2,073 inlets were cleaned as a response to work related to other service requests or a proactive measure to prevent flooding prior to a major forecasted storm.

During Fiscal Years 2011 and 2012, UMD removed 1,431 tons and 926 of debris from the City's public inlets, respectively.

Further discussions of the benefit of inlet cleaning and its relation to the City's impervious area goal are provided under "Street Sweeping and Inlet Cleaning" in Section F3, "Annual Reporting" of this report.

b. **Integrated Pest Management**

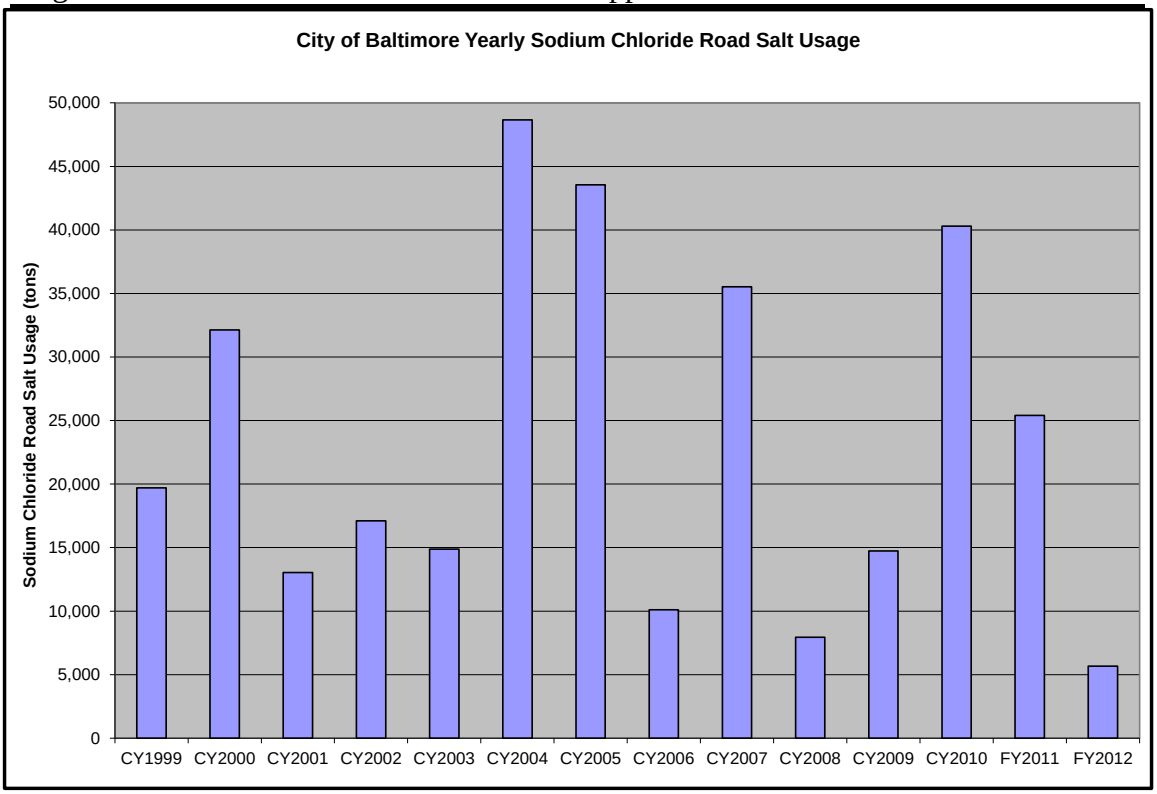
Table D5b.1 lists the type and amount of pesticide, herbicide and fertilizer used by the Department of Transportation each year for 1999 through 2012. The Department of Transportation applies herbicides from May through September.

Table D5b.1 Bureau of Highways Pesticide, Herbicide and Fertilizer Usage										
Product	Snapshot 2.5 TG	Brushmaster	Lesco Three Way	Oust	Round-up Pro or equivalent	Proxy	Lesco Professional Turf Fertilizer	Scythe	Sahara Herbicide	Sahara Herbicide
Unit	lb	gal	gal	gal	gal	gal	lb	gal	gal	lb
1999	150	18	78	69	171	20	1000	0	0	0
2000	150	15	33	0	145	10.5	0	28	0	0
2001	0	0	0	0	256	14	0	0	0	0
2002	0	10	70	0	160	14	0	0	20	0
2003	0	3	0	0	120	5	0	0	0	7
2004	0	40	0	0	120	0	0	0	0	20
2005	0	60	0	0	125	0	0	0	0	16
2006	0	120	0	0	175	0	0	0	0	20
2007	0	100	0	0	125	0	0	0	0	0
2008	0	135	0	0	140	0	0	0	0	0
2009	0	125	0	0	135	0	0	0	0	0
2010	0	135	0	0	145	0	0	0	0	0
2011	0	110	0	0	130	0	0	0	0	0
2012	0	130	0	0	140	0	0	0	0	0

c. **Deicing Materials**

The Department of Transportation applied 25,409 tons of sodium chloride during Fiscal Year 2011 (July 2010 through June 2011) and 5,668 tons during Fiscal Year 2012 (July 2011 through June 2012). Figure D5c.1 displays the amount of sodium chloride applied for each calendar year 1999 through 2010 and then each fiscal year for 2011 and 2012.

Figure D5c.1 Amount of Sodium Chloride Applied to Roads



6. **Public Education**

   a. **Outreach Efforts to the Public**

   In Fiscal Year 2012, DPW initiated a community liaison program in which staff was geographically assigned to routinely meet with community, business, and political leaders associated with that area. DPW's communications also started to develop materials related to trash/ litter, pet waste and a fat-oil-grease (FOG) reduction program.

   DPW initiated water resource appreciation events including Dam Jam, an event at Loch Raven Dam in September 2011.

   b. **Outreach to Industry**

   The Pollution Control Section of the Environmental Services Division conducts annual inspections of "significant industrial users" of the sanitary sewer system: currently there are 23 significant industrial users. The Pollution Control Section revised their check list in September 2010 to include additional stormwater related industrial site information. A copy of the revised inspection check list was included on the CD-ROM that accompanied the 2010 annual report. Copies of the inspection reports are available to view by appointment at the offices of Pollution Control Section.

E. Watershed Assessment and Planning

1. **Watershed Management Plans**
   There are five watersheds at the 8-digit scale into which parts of the City drain: Back River, Baltimore Harbor, Gwynns Falls, Jones Falls and Patapsco River. The City completed watershed studies of Gwynns Falls in 2004, and Jones Falls and Back River in 2008. During this reporting period, SWMD contracted consulting services with PB Americas to initiate a watershed assessment of the Baltimore Harbor watershed in Fiscal Year 2013.

2. **Watershed Assessment from Chemical Monitoring**
   The folder "City Streams Dry Weather Time Concentration Graphs" on the accompanying CD-ROM of this report contains a set of 18 Excel files. Each Excel file contains a set of concentration versus sampling date time graphs for a given water quality parameter for samples collected during dry weather for all the City's stations, including the four Moores Run stations (discussed in Section G1a). The parameters that were graphed are (alphabetically by file name):
   - ammonia nitrogen (lab measurement);
   - ammonia nitrogen (field measurement);
   - biological oxygen demand (BOD 5-day);
   - chlorides;
   - chemical oxygen demand (COD);
   - conductivity (lab measurement);
   - total copper;
   - e. coli MPN counts,
   - enterococcus MPN counts,
   - fecal coliform counts;
   - fluoride;
   - nitrate+nitrite nitrogen;
   - sodium (only measured for the stations Powder Mill, Dead Run Dnst., Maidens Choice and Radecke Ave.);
   - total suspended solids;
   - total Kjeldahl nitrogen (TKN);
   - total nitrogen (estimated by the sum of TKN with nitrate+nitrite nitrogen);
   - total phosphorus; and
   - total zinc.

   Starting on September 10, 2003, the DPW lab which SWMD used switched to automated technology made by Skalar to measure nitrogen and phosphorus. SWMD noted a difference in the results following the switch in analytical technologies. On each graph for nitrogen and phosphorus parameters there is a green vertical line marking the date the switch was made. Beginning in January 20, 2009, SWMD had to switch to using a contracted lab for total phosphorus, TKN and nitrate+nitrite nitrogen analyses because the State de-

certified the DPW lab for measuring those analytes. On each graph for nitrogen and phosphorus parameters, there is a red vertical line marking this date. The concentrations since the switch to the contracted lab appear lower than they were for the period- September 10, 2003 through January 20, 2009- when the DPW lab was using the Skalar equipment to measure phosphorus and nitrogen.

E. Coli and Enterococci MPN Count Analysis

Since November 2008, SWMD modified SIS protocol to replace fecal coliform MPN counts with e. coli MPN counts. Since April 2009, SWMD switched to having enterococci MPN counts performed on the Baltimore Harbor and Patapsco River watershed SIS stations and the Lombard St. station in the Jones Falls watershed since enterococci are considered a better indicator to use for marine waters. Since April 2009, SWMD has been collecting samples for enterococci MPN counts at the marine water SIS stations twice each month.

Table E2.1 lists the e. coli MPN count geometric mean and the percentage of surface water dry weather grab samples collected through December 2012 for which the e. coli MPN count was at below each of the four water contact use categories for each freshwater sampling station. Figure E2.1 depicts the percentage of samples for which the e. coli MPN count was at below the infrequent full body contact recreation guideline (576 MPN/100 ml) for each freshwater sampling station.

Table E2.2 lists the enterococci MPN count geometric mean and the percentage of surface water dry weather grab samples collected through June 2012 for which the enterococci MPN count was at below each of the four water contact use categories for each marine water sampling station. Figure E2.2 depicts the percentage of dry weather samples for which the enterococci MPN count was at below the infrequent full body contact recreation guideline (500 MPN/100 ml) for each marine water sampling station.

Table E2.1 E. Coli MPN Counts: Geometric Means and Comparison to State's Criteria for Frequency of Contact (Dry Weather Samples November 2008 through December 2012)									
Station	ID	Number of Samples	Number of Samples Included for the Geometric Mean	Geometric Mean (MPN/100 ml)	Percent At or Below Frequent Full Body Contact Recreation (235 MPN/100 ml)	Percent At or Below Moderately Frequent Full Body Contact Recreation (298 MPN/100 ml)	Percent At or Below Occasional Full Body Contact Recreation (410 MPN/100 ml)	Percent At or Below Infrequent Full Body Contact Recreation (576 MPN/100 ml)	Percent Above Infrequent Full Body Contact Recreation (576 MPN/100 ml)
Back River Watershed Herring Run Sub-watershed									
PERRING PKWY	HR-1	42	42	1,200	14%	14%	24%	33%	67%
MT. PLEASANT GC	HR-2	42	42	1,900	10%	12%	19%	19%	81%
CHINQUAPIN RUN	HR-3	42	42	700	24%	24%	31%	40%	60%
TIFFANY RUN	HR-4	42	42	610	33%	33%	43%	60%	40%
HARFORD RD.	HR-5	42	42	1,100	14%	19%	33%	38%	62%
WRIGHT AVE.	HR-6	42	42	810	29%	36%	40%	48%	52%
PULASKI HWY.	HR-7	42	42	600	29%	29%	38%	55%	45%
Back River Watershed Moores Run Sub-watershed									
MARY AVE.	MR-1	42	42	3,400	2%	5%	10%	14%	86%
HAMILTON AVE.	MR-2	42	42	2,900	2%	5%	7%	12%	88%
RADECKE AVE.	MR-3	42	42	1,600	10%	10%	26%	29%	71%
BIDDLE ST. & 62ND ST	MR-4	42	42	750	24%	26%	36%	43%	57%
Jones Falls Watershed									
SMITH AVE.	JF-1	45	45	120	76%	78%	80%	84%	16%
WESTERN RUN	JF-2	45	44	890	24%	27%	33%	47%	53%
STONY RUN	JF-3	45	45	370	44%	47%	64%	76%	24%
Gwynns Falls Watershed									
POWDER MILL	GF-1	45	45	830	18%	22%	33%	40%	60%
PURNELL DR.	GF-2	42	42	630	21%	24%	36%	57%	43%
DEAD RUN DNST.	GF-3	42	42	240	45%	48%	69%	76%	24%
GWYNNS FALLS PKWY.	GF-4	42	42	210	60%	62%	67%	74%	26%
GRUN HILTON ST.	GF-5	42	42	3,400	5%	7%	14%	17%	83%
GF HILTON ST.	GF-6	42	42	470	40%	40%	50%	62%	38%
MAIDENS CHOICE	GF-7	41	41	490	39%	41%	49%	61%	39%
GRUN CARROLL PARK	GF-8	41	41	11,000	2%	2%	2%	2%	98%
WASHINGTON BLVD.	GF-9	41	41	2,900	2%	2%	5%	7%	93%

Figure E2.1 Percent E. Coli MPN Counts At or Below the Infrequent Full Body Contact Recreation Guideline (576 MPN/100 ml)

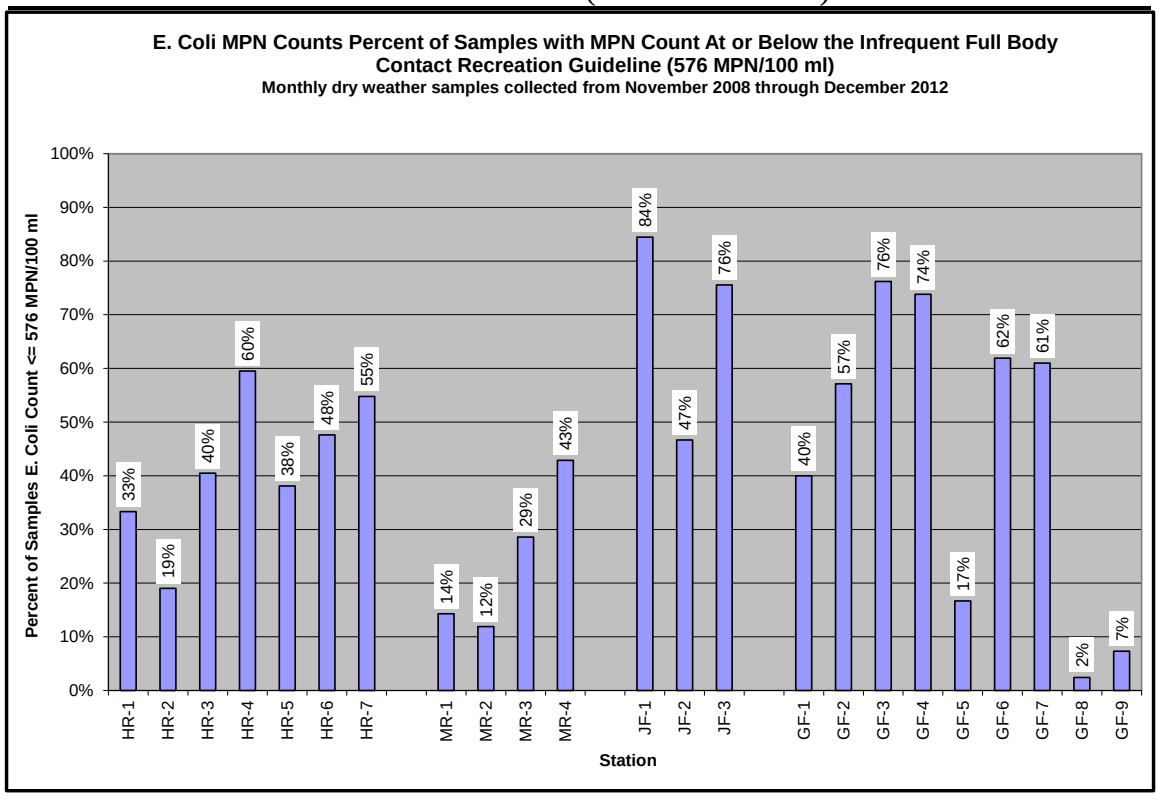
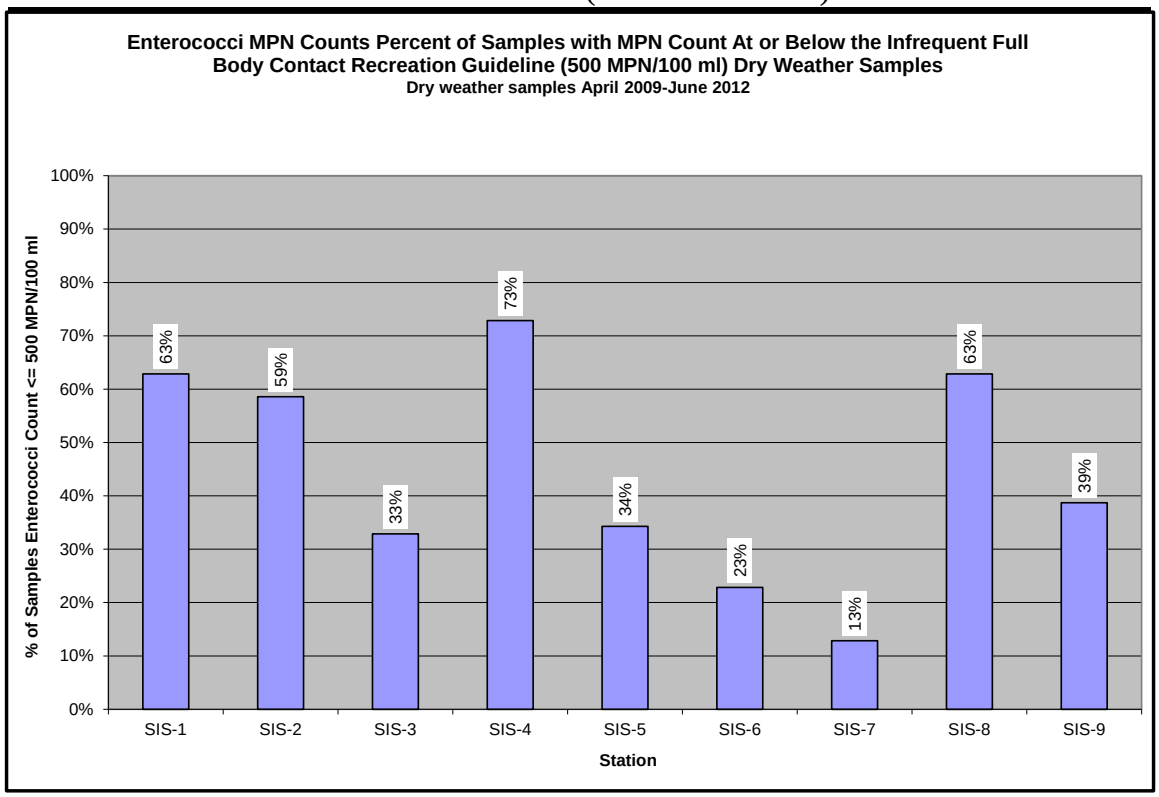


Table E2.2 Enterococci MPN Counts from Dry Weather Samples: Geometric Means and Comparision to State's Criteria for Frequency of Contact (April 2009 through June 2012)									
Station	Station ID	Number of Samples	Number of Samples Included for the Geometric Mean	Geometric Mean (MPN/100 ml)	Per Cent At or Below Frequent Full Body Contact Recreation (104 MPN/100 ml)	Per Cent At or Below Moderately Frequent Full Body Contact Recreation (158 MPN/100 ml)	Per Cent At or Below Occasional Full Body Contact Recreation (275 MPN/100 ml)	Per Cent At or Below Infrequent Full Body Contact Recreation (500 MPN/100 ml)	Per Cent Above Infrequent Full Body Contact Recreation (500 MPN/100 ml)
Patapsco River Watershed SIS Stations									
REEDBIRD AVE.	SIS-1	70	69	220	40%	47%	54%	63%	37%
Baltimore Harbor Watershed SIS Stations									
WATERVIEW AVE.	SIS-2	70	69	350	21%	26%	40%	59%	41%
WARNER & ALLUVION	SIS-3	70	68	910	11%	16%	26%	33%	67%
LIGHT ST.	SIS-4	70	70	130	43%	51%	60%	73%	27%
CENTRAL & LANCASTER	SIS-5	70	69	950	7%	14%	24%	34%	66%
LAKEWOOD AVE.	SIS-6	70	67	1,600	1%	1%	10%	23%	77%
LINWOOD AVE.	SIS-7	70	67	4,800	1%	4%	7%	13%	87%
JANEY RUN	SIS-8	70	68	150	46%	47%	53%	63%	37%
Jones Falls Watershed SIS Stations									
LOMBARD ST.	SIS-9	62	62	850	8%	13%	24%	39%	61%

Figure E2.2 Percent Enterococci MPN Counts At or Below the Infrequent Full Body Contact Recreation Guideline (500 MPN/100 ml)



Total Phosphorus and Total Nitrogen Analyses

Table E2.3 lists the percentages for each station of the dry weather grab surface water samples collected from January 2009 through December 2012 which were at or exceeded these nutrient concentration guidelines: total phosphorus at 0.1 mg/L, and total nitrogen (estimated by the sum of total Kjeldahl nitrogen and nitrate+nitrite nitrogen) at 3 mg/L. Following a convention that the State used in its Maryland Water Quality Inventory, 1993-1995, a water quality level was assigned for each station's sample sets: "normal" (shown by light green highlight) if the percentage was less than 11%; "elevated" (shown by light yellow highlight) if it was between 11% and

25%; and "high" (shown by rose highlight) if it was greater than 25%. The Baltimore Harbor set of stations have the highest levels of phosphorus and nitrogen; the Back River watershed stations have the lowest levels of phosphorus and nitrogen. The stations with the highest levels are LINWOOD AVE. in the Baltimore Harbor watershed and GRUN CARROLL PARK in the Gwynns Falls watershed.

Table E2.3 Percent of Dry Weather Samples Exceeding Guidelines for Total Phosphorus or Total Nitrogen (January 2009 through December 2012)

Station	Percent of Samples Total Phosphorus >=0.1 mg/L	Percent of Samples Total Nitrogen >=3 mg/L
Back River Watershed Herring Run Sub-watershed		
PERRING PKWY	29%	0%
MT. PLEASANT GC	41%	5%
CHINQUAPIN RUN	29%	11%
TIFFANY RUN	17%	0%
HARFORD RD.	29%	2%
WRIGHT AVE.	39%	2%
PULASKI HWY.	17%	5%
Back River Watershed Moores Run Sub-watershed		
MARY AVE.	50%	8%
HAMILTON AVE.	45%	25%
RADECKE AVE.	33%	13%
BIDDLE ST. & 62ND ST.	54%	0%
Jones Falls Watershed		
SMITH AVE.	39%	0%
WESTERN RUN	39%	5%
LINKWOOD	37%	16%
STONY RUN	34%	13%
LOMBARD ST.	45%	2%
Gwynns Falls Watershed		
POWDER MILL	41%	10%
PURNELL DR.	41%	0%
DEAD RUN DNST.	51%	0%
GWYNNS FALLS PKWY.	49%	5%
GRUN HILTON ST.	49%	0%
GF HILTON ST.	46%	0%
MAIDENS CHOICE	47%	5%
GRUN CARROLL PARK	76%	32%
WASHINGTON BLVD.	39%	3%

Key

	Normal: <= 11% of Samples
	Elevated: Between 11-25% of Samples
	High: >25% of Samples

Table E2.3 Percent of Dry Weather Samples Exceeding Guidelines for Total Phosphorus or Total Nitrogen (January 2009 through December 2012) (continued)		
Station	Percent of Samples Total Phosphorus >=0.1 mg/L	Percent of Samples Total Nitrogen >=3 mg/L
Baltimore Harbor Watershed		
LINWOOD AVE.	89%	34%
LAKEWOOD AVE.	64%	16%
CENTRAL & LANCASTER	58%	4%
LIGHT ST.	51%	4%
WARNER & ALLUVION	58%	2%
WATERVIEW AVE.	41%	11%
JANEY RUN	47%	4%
Patapsco River Watershed		
REEDBIRD AVE.	49%	7%
Key		
Normal: <= 11% of Samples		
Elevated: Between 11-25% of Samples		
High: >25% of Samples		

3. **Watershed Assessment from Biological Monitoring**
SWMD conducts biological monitoring for benthic macroinvertebrates within three of the watersheds: Gwynns Falls, Jones Falls and Back River- using a combination of random and fixed site sampling. Each year, one watershed is chosen for the random sampling. SWMD uses the method for calculating genus IBI scores for benthic macroinvertebrates that the Maryland Biological Stream Survey (MBSS) presented in their October 2005 report, "New Biological Indicators to Better Assess the Condition of Maryland Streams". A record for each macroinvertebrate sample and its resulting BIBI score is provided in the Excel file "Macroinvertebrate Sample Results 2002 through 2012.xls" on the CD-ROM accompanying this report.

During 2011, benthic macroinvertebrates were collected at 28 stations:

- 20 random stations in the Jones Falls watershed;
- 2 fixed stations in the Gwynns Falls watershed;
- 1 fixed station on Biddison Run (in the Back River watershed) associated with the stream restoration monitoring;
- 3 fixed stations on Stony Run (in the Jones Falls watershed) associated with the stream restoration monitoring; and
- 2 fixed stations in the upper Moores Run sub-watershed (in the Back River watershed) associated with the two long-term discharge characterization stations.

During 2012, benthic macroinvertebrates were collected at 18 stations:

- 10 random stations in the Gwynns Falls watershed;
- 2 fixed stations in the Gwynns Falls watershed;
- 1 fixed station on Biddison Run (in the Back River watershed) associated with the stream restoration monitoring;
- 3 fixed stations on Stony Run (in the Jones Falls watershed) associated with the stream restoration monitoring; and
- 2 fixed stations in the upper Moores Run sub-watershed (in the Back River watershed) associated with the two long-term discharge characterization stations.

Figure E3.1 presents the genus BIBI scores for the macroinvertebrates collected at the 20 random sites in the Jones Falls watershed collected in 2011. Figure E3.2 presents percentile rank versus genus IBI scores for the benthic macroinvertebrate samples for each group of Jones Falls watershed random samplings (2002, 2005, 2008 and 2011). Each curve presents the distribution of the scores for a given year. The 2011 group ranks slightly better than the other years- except the 2002 maximum score was better than the 2011 maximum.

Figure E3.3 presents the genus BIBI scores for the macroinvertebrates collected at the 10 random sites in the Gwynns Falls watershed collected in 2012. Figure E3.4 presents percentile rank versus genus IBI scores for the benthic macroinvertebrate samples for each group of Gwynns Falls watershed random samplings (2003, 2006, 2009 and 2012). The 2012 group ranks as the worst by a slight margin compared to the other years.

Table E3.1 lists the genus BIBI scores for the fixed site samples from 2002 through 2012. Figure E3.5 presents the BIBI scores over the years for each of the two Gwynns Falls watershed fixed stations. Figure E3.6 presents the BIBI scores over the years for each of the three Jones Falls watershed fixed stations. Figure E3.7 presents the BIBI scores over the years for each of the three Back River watershed fixed stations.

Figure E3.1 Benthic Macroinvertebrates Genus BIBI Scores for Jones Falls Watershed Random Stations Sampled During 2011

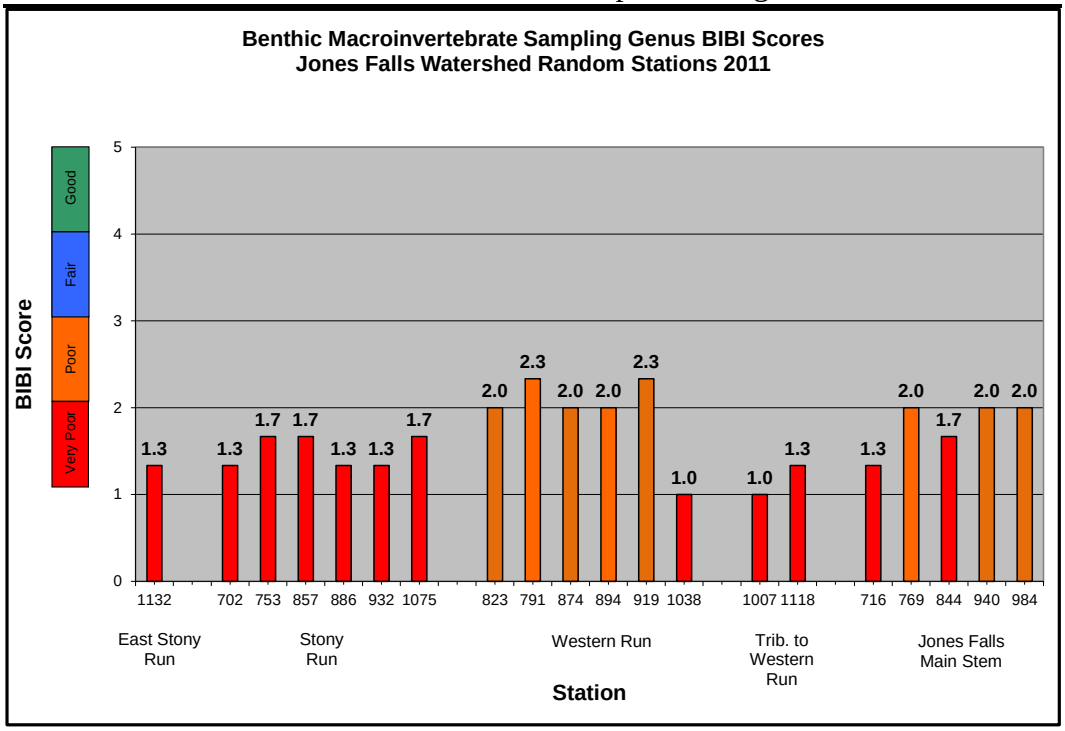


Figure E3.2 Comparison of the Genus BIBI Scores for Macroinvertebrate Samples from Jones Falls Watershed Random Sampling Groups 2002, 2005, 2008 & 2011

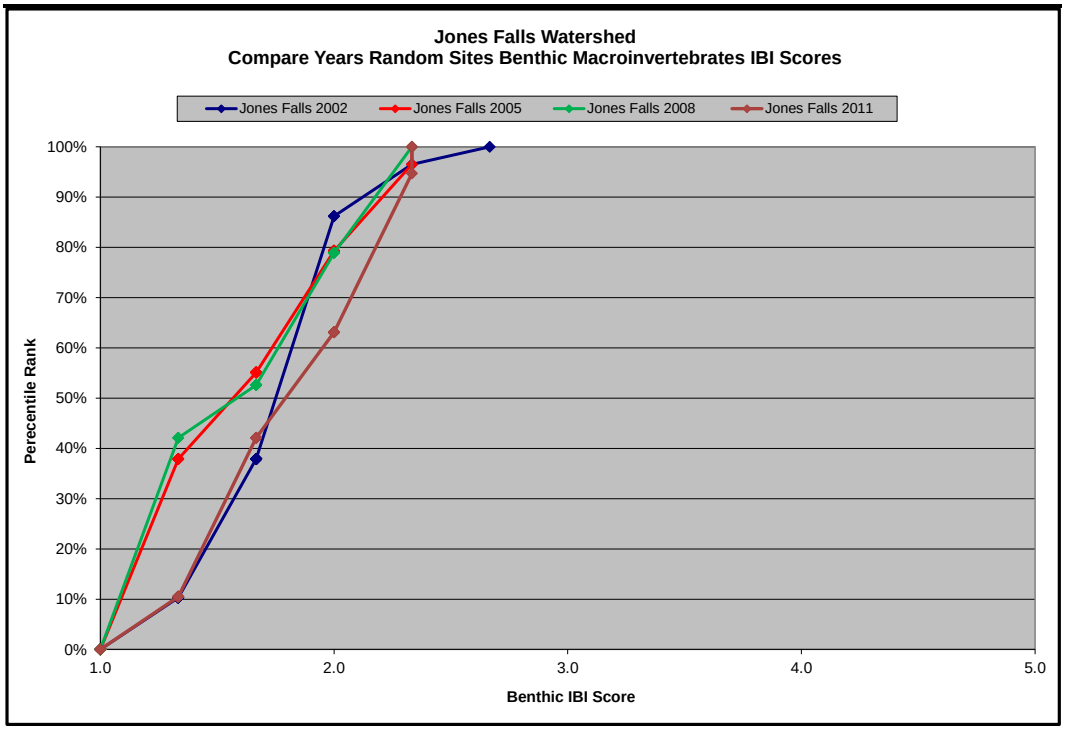


Figure E3.3 Benthic Macroinvertebrates Genus BIBI Scores for Gwynns Falls Watershed Random Stations Sampled During 2012

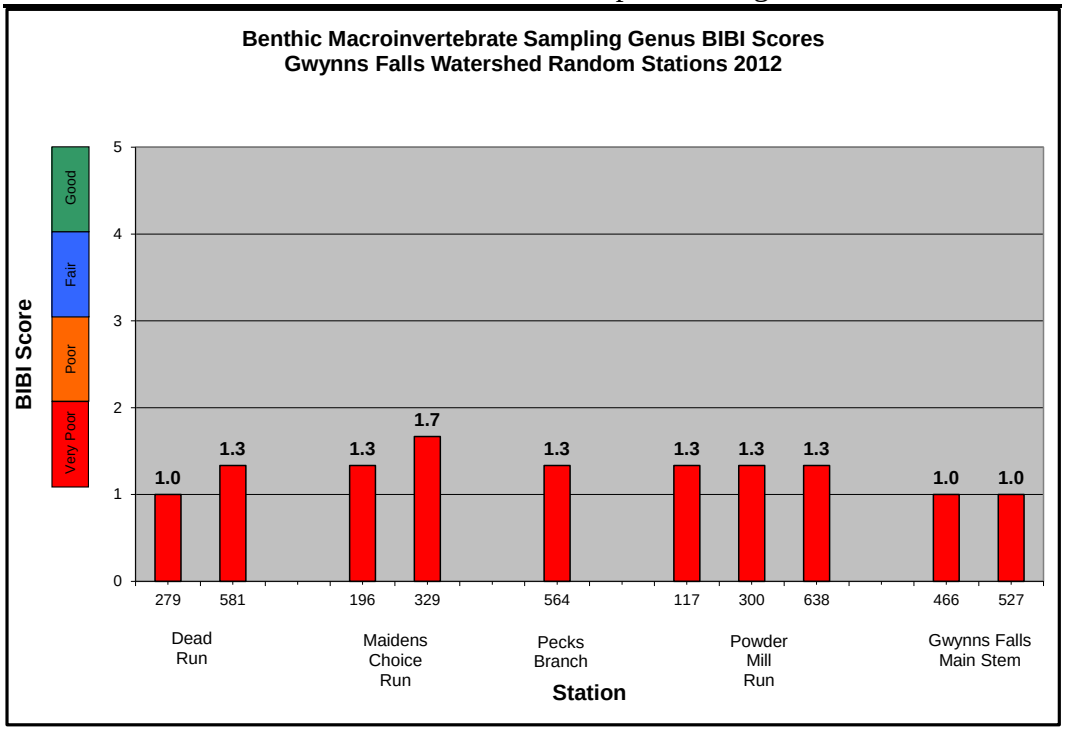


Figure E3.4 Comparison of the Genus BIBI Scores for Macroinvertebrate Samples from Gwynns Falls Watershed Random Sampling Groups 2003, 2006, 2009 & 2012

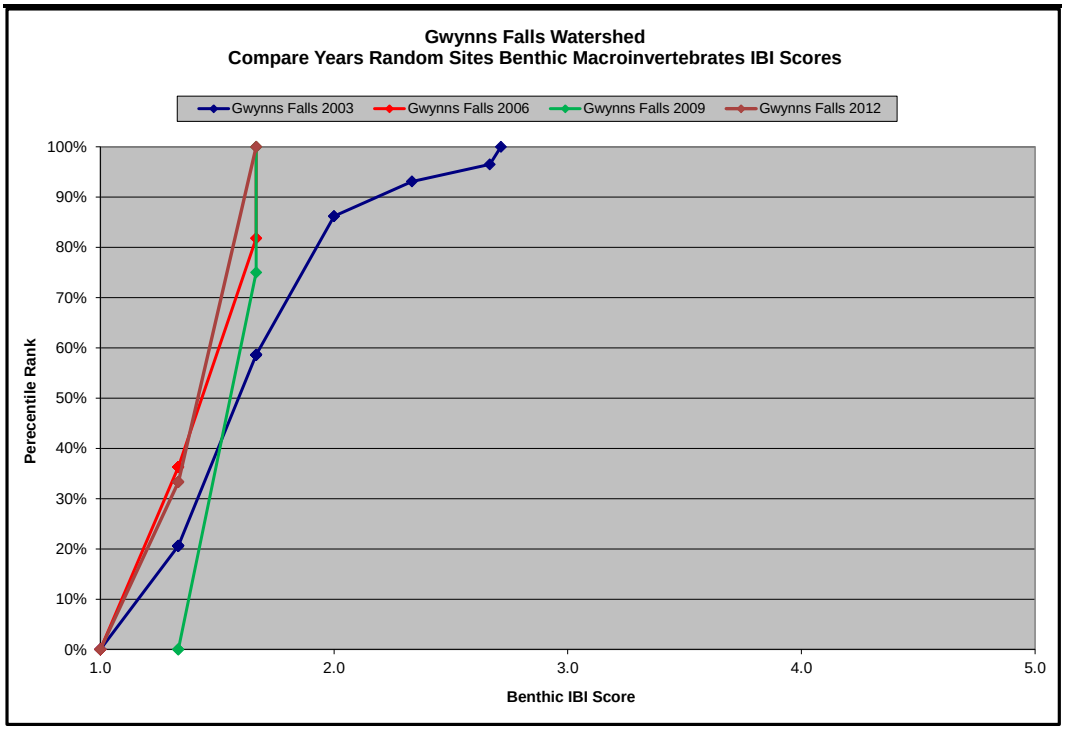


Table E3.1 Comparison of Benthic Macroinvertebrate BIBI Results for Samples from the Fixed Stations for 2002-2012
(Note: the shaded rows indicate the fixed stations that are designated for continuing annual sampling.)

Station	Stream	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Gwynns Falls Watershed												
250	Dead Run	1.7	1.0	1.0	1.0	1.7	---	---	1.3	1.3	2.3	1.0
325	Gwynns Falls	1.0	---	---	---	---	---	---	---	---	---	---
403	Gwynns Falls	1.3	---	1.0	1.0	---	---	---	---	---	---	---
430	Maidens Choice Run	---	---	---	---	---	---	---	---	1.0	1.7	1.0
566	Powder Mill Run	---	---	1.3	1.0	---	---	---	---	---	---	---
625	Maidens Choice Run	1.3	1.3	1.0	1.3	---	---	---	---	---	---	---
Jones Falls Watershed												
878	Stony Run	1.3	1.3	---	---	---	---	---	---	---	---	---
880	Stony Run	---	---	---	---	---	---	---	---	1.3	1.3	1.0
949	Stony Run	---	---	---	---	---	---	---	---	1.7	1.0	1.0
964	Western Run	1.3	1.7	---	1.7	---	---	---	---	---	---	---
1053	Stony Run	1.3	1.0	1.0	1.3	---	1.0	1.0	1.3	2.3	1.7	1.0
1112	Jones Falls	---	---	1.0	1.0	---	---	---	---	---	---	---
Back River Watershed												
1231	Biddison Run	---	2.4	1.9	1.6	1.6	1.0	1.6	---	---	---	---
1235	Biddison Run	---	3.3	1.3	1.9	1.3	1.3	1.6	1.0	1.9	1.3	1.6
1271	Herring Run	1.3	1.0	---	---	---	---	---	---	---	---	---
1294	Herring Run	1.3	1.0	---	---	---	---	---	---	---	---	---
1302	Herring Run	2.0	1.0	---	---	---	---	---	---	---	---	---
1367	Moores Run	1.3	1.3	1.0	1.3	1.7	1.3	---	1.3	1.3	1.3	1.7
1392	Moores Run	1.9	1.6	1.0	1.3	1.0	1.0	2.4	---	---	---	---
1583	Chinquapin Run	1.0	1.0	1.0	---	---	---	---	---	---	---	---
1600	Herring Run	---	---	1.0	1.3	---	---	---	---	---	---	---
1634	Moores Run Trib.	1.3	1.3	1.3	2.0	---	1.0	---	---	---	---	---
1659	Moores Run Trib.	1.3	1.7	1.0	1.3	1.7	1.3	1.7	1.3	1.7	1.7	1.0

Figure E3.5 Benthic Macroinvertebrates Genus BIBI Scores for the Two Gwynns Falls Watershed Fixed Stations 2002-2012

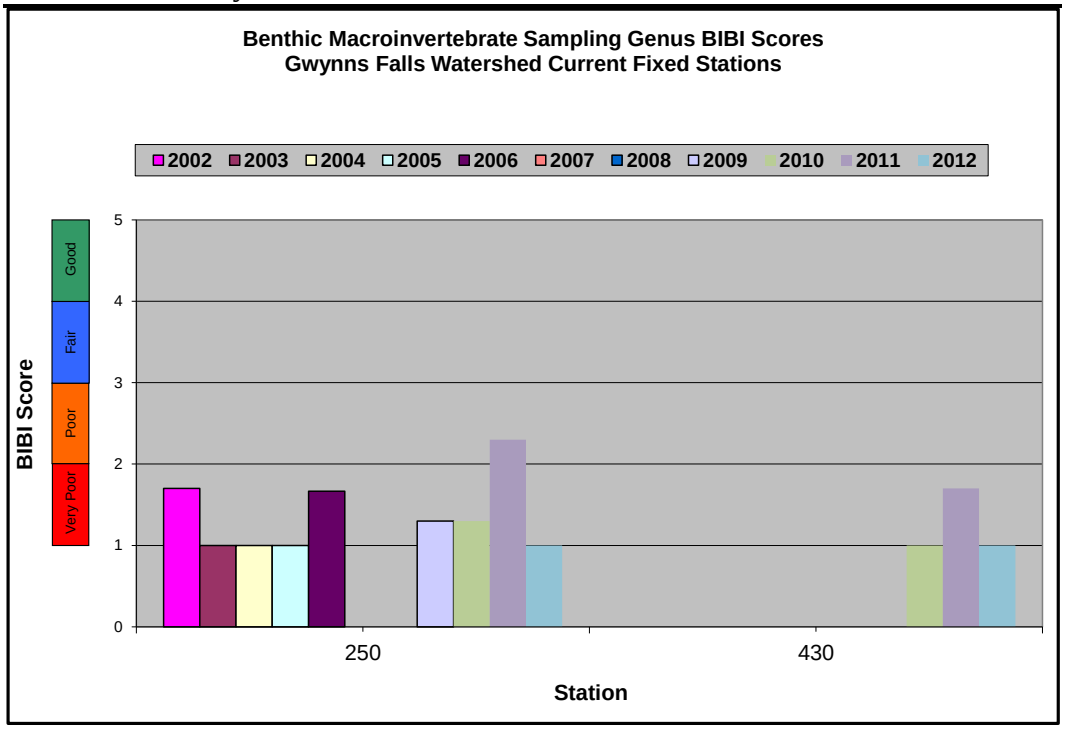


Figure E3.6 Benthic Macroinvertebrates Genus BIBI Scores for the Three Jones Falls Watershed Fixed Stations 2002-2012

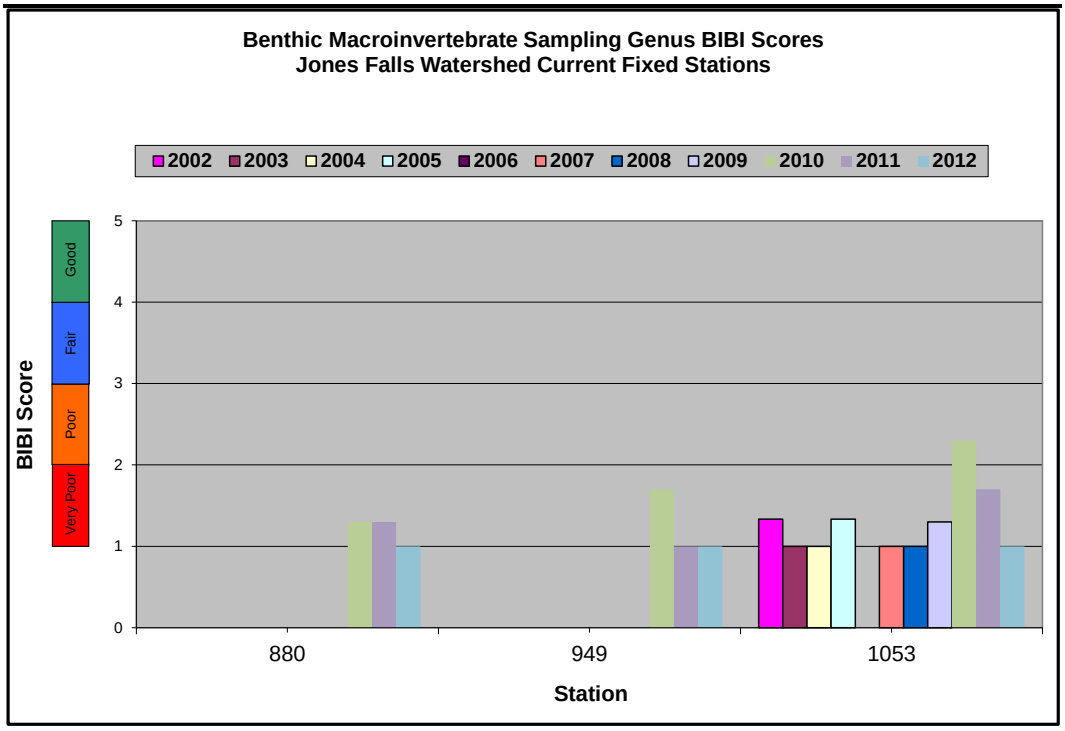
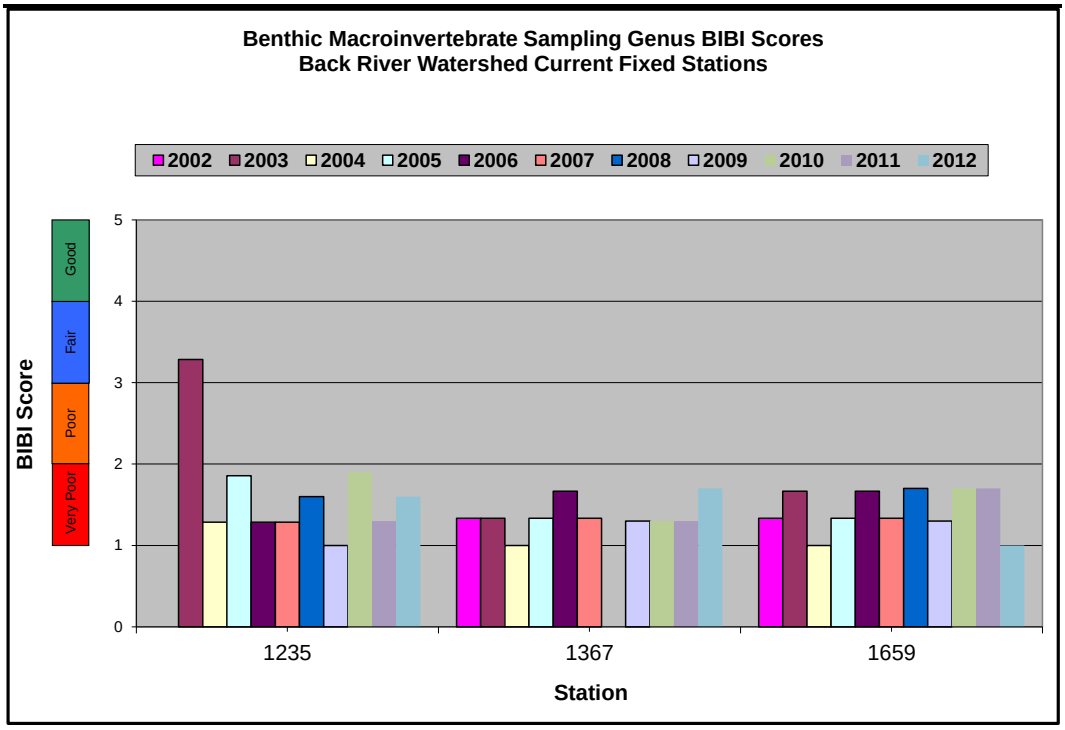


Figure E3.7 Benthic Macroinvertebrates Genus BIBI Scores for the Three Back River Watershed Fixed Stations 2002-2012



F. Watershed Restoration

1. **Implementation Schedule**
   This section presents the watershed restoration practices that are under construction, pending construction or were recently completed. It should be noted that the projects reported as "pending" are subject to many unforeseen variables that can result in schedule and budget impacts. A description of the delays and a revised schedule for the affected projects is presented below.

   Gwynns Falls Watershed Capital Improvements

   ER4018 Powder Mill Environmental Restoration Project 1

   Design Cost: $478,422
   Construction Cost: $2,500,000

   Description: Stream Restoration of 3,900 linear feet of Powder Mill Run near Northern Parkway.

   Status: Completed 60% design in August 2009. Design to 90% was put on hold because the City is negotiating an agreement with the US Army Corps of Engineers (USACE) for design and construction assistance for

the Powder Mill Restoration Project. Negotiations were continued with the USACE until the spring of 2012, when it was realized that federal funding for the project through construction was uncertain. The City decided to pursue continuing design and construction (self-funded) in 2013.

Jones Falls Watershed Capital Improvements

Open Channel Improvements- East Stony Run

Design Cost: $459,000
Construction Cost: $699,385

Description: Stream Restoration of approximately 800 feet of the East Stony Run.

Status: In 2010, revised design plans were completed and all easements were obtained. The project was advertised for bid twice during this reporting period; both times the bids received exceeded the available budgets. A third advertisement was planned for Fiscal Year 2013, pending MDE/USACE waterway permitting extension.

Lower Lower Stony Run Stream Restoration Project (ER4020)

Design Cost: $408,000
Construction Cost: $2,700,000
Description: Stream Restoration of the lowest reach of the Stony Run stream, from approximately 1,400 feet below University Parkway until the stream enters a culvert in Wyman Park. The original plan was to restore only 4,500 linear feet of the stream. An additional 500 linear feet of a tributary has been added to the plan. The goals for this additional design will be to stabilize the channel and prevent erosion and undermining of the existing bridge crossing under San Martin Blvd. on Johns Hopkins University.

Status: Following the completion of 60% design in 2010, additional scope was added to the project to address a failing slope related to an adjacent walking trail and to address an undersized outfall pipe which was surcharging an upstream manhole and causing significant erosion. During this reporting period, DPW explored additional funding, in addition to contracting additional consulting services. Final design and construction costs were not determined during this period.

Back River Watershed Capital Improvements

Moores Run Wetland

Design Cost: $147,500
Construction Cost: $3,200,000

Description: Wetland creation project in the Frankford neighborhood, located east of Denview Way between Relcrest Road and Force Drive and west of Moores Run. The facility will divert storm flows from Moores Run through a new wetland area. The facility is designed to treat approximately 18% of the upstream runoff from the contributing drainage area (2,800 acres). To address forest mitigation requirements, trees will be planted at the Moravia Park Elementary School.

Status: In 2012, the City decided to no longer pursue this project, due to a conflict with a large water transmission main that crossed through the footprint of the wetland project.

Biddison Run Stream Stabilization (Project ER4023)

Design Cost: $310,474
Construction Cost: not yet determined

Description: Stream restoration of approximately 6,900 linear feet of the Biddison Run, from Sipple Avenue to Moravia Road. This project is part of the Masonville Dredge Spoil mitigation plan. Significant slope failure along the right stream bank increased in 2010, extending under the roadway of Moravia Road.

Status: In 2010, 30% designs were completed and submitted to City agencies for review. Design efforts were diverted to address the slope failure portion of the project; construction efforts to address the slope failure were anticipated to be completed in 2012, but were postponed due to limited funding in Fiscal Year 2012.

Baltimore Harbor Watershed Capital Improvements

Bush Street Trash-Debris Collector

Design Cost: $242,550
Construction Cost: $2,000,000

Description: Debris collection system to capture floatable debris from the heavily urbanized 930 acre Watershed 263. This project is part of the Masonville Dredge Spoil mitigation plan.

Status: During the reporting period, the City worked with the Maryland Port Administration to determine the final approach for meeting the

mitigation plan, including negotiations with permitting agencies. DPW also initiated an investigation to reduce construction costs.

Watershed 263 Ultra-Urban BMP Project Phase 2

Design Cost: $200,000
Construction Cost: $493,025

Description: Installation of BMPs for two locations in Watershed 263: curb extension and a conversion of a paved park to a bio-retention cell. Since the 2009 Annual Report, the scope has been reduced to these two locations due to ownership problems and a cost-benefit analysis.

Status: During the reporting period, 100% designs were completed and approved by various City agencies. Construction is anticipated to begin in September 2013.

2. **Restoration Monitoring**

This section describes the monitoring which continues in Stony Run after the completion of the stream restoration projects.

In June 2005, the City established the Linkwood stormwater monitoring station on Stony Run in the Jones Falls watershed to use for assessing restoration in Stony Run, and to meet MS4 permit requirements. In December 2005, the City decided to use its Powder Mill SIS station located in the Gwynns Falls watershed as the control in this study. The USGS provides flow monitoring at both the Linkwood (USGS station ID 01589464) and the Powder Mill (USGS station ID 01589305) stations.

In June 2009, the City established the stormwater sampling station Kennison at one of the outfalls to Powder Mill Run. The USGS does not have flow monitoring equipment at this station; therefore, a flow rating has not been established yet to use with the water level measuring equipment. The Kennison sampling station was established in anticipation of restoration construction planned for Powder Mill Run. Unfortunately, the equipment at the Kennison station was destroyed by violent storm flows during August 2011, and SWMD decided not to rebuild the station.

Table F2.1 lists the number of samples, and the number of water quality analyses performed on those samples, collected for this monitoring project during Fiscal Year 2011 and Table F2.2 lists the numbers for Fiscal Year 2012.

Table F2.1 Stony Run and Powder Mill Restoration Monitoring During Fiscal Year 2011 (7/1/2010 to 6/30/2011)

Station and Type	Number of Surveys or Storm Events	Number of Samples	Number of Water Quality Analyses Performed
Linkwood Baseline	12	12	128
Powder Mill Baseline	12	12	224
Linkwood Storm	7	51	255
Powder Mill Storm	8	70	350
Kennison Storm	8	64	320
Total			1,277

Table F2.2 Stony Run and Powder Mill Restoration Monitoring During Fiscal Year 2012 (7/1/2011 to 6/30/2012)

Station and Type	Number of Surveys or Storm Events	Number of Samples	Number of Water Quality Analyses Performed
Linkwood Baseline	12	12	128
Powder Mill Baseline	12	12	226
Linkwood Storm	11	69	345
Powder Mill Storm	10	62	310
Kennison Storm	0	0	0
Total			1,009

Total phosphorus, nitrate+nitrite nitrogen and total Kjeldahl nitrogen are analyzed for samples collected at the Linkwood station. Table E2.3 lists the percentage of dry weather samples from Linkwood from January 2009 through December 2012 which exceed the guideline for total phosphorus (0.1 mg/L) as 37%, which is in the "high" range; and for total nitrogen (3 mg/L) as 16%, which is in the "elevated" range. The Powder Mill SIS station had 41% of its dry weather samples exceed the total phosphorus guideline (which ranks the station in the "high" range); and 10% exceed the guideline for total nitrogen (which ranks the station in the "normal" range).

At each station, discrete stormwater samples were collected by an automated sampler at timed intervals once the stream level rises above the programmed trigger level. Using the discrete sample concentrations and the storm's flow records, a storm event mean concentration (EMC) was calculated for each station for each parameter for each storm. Figures F2.1 through F2.6 present the storm EMC for each storm for both Linkwood and Powder Mill for the following parameters: total

phosphorus, total nitrogen (estimated as the sum of TKN and nitrate+nitrite nitrogen), TKN, nitrate+nitrite nitrogen, total suspended solids and volatile suspended solids. Between January 2011 and June 2012 there were 16 storm events monitored. These events were assigned storm numbers 59 through 74.

The storm EMC and baseline results for Linkwood and Powder Mill stations for January 2011 through June 2012 are included in the table "Baltimore City Chemical Monitoring Jan 2011 Jun 2012" in the Access database "Baltimore City NPDES Stormwater Permit Data Jan 2011 to Jun 2012.mdb" on the CD-ROM accompanying this report. The results from discrete storm samples, as well as all other sample results, from these stations for January 2011 through June 2012 can be found in the table "Baltimore City Monitoring Sample Results Jan 2011 Jun 2012" in that Access database.

Figure F2c.1 Linkwood & Powder Mill Total Phosphorus Storm EMCs

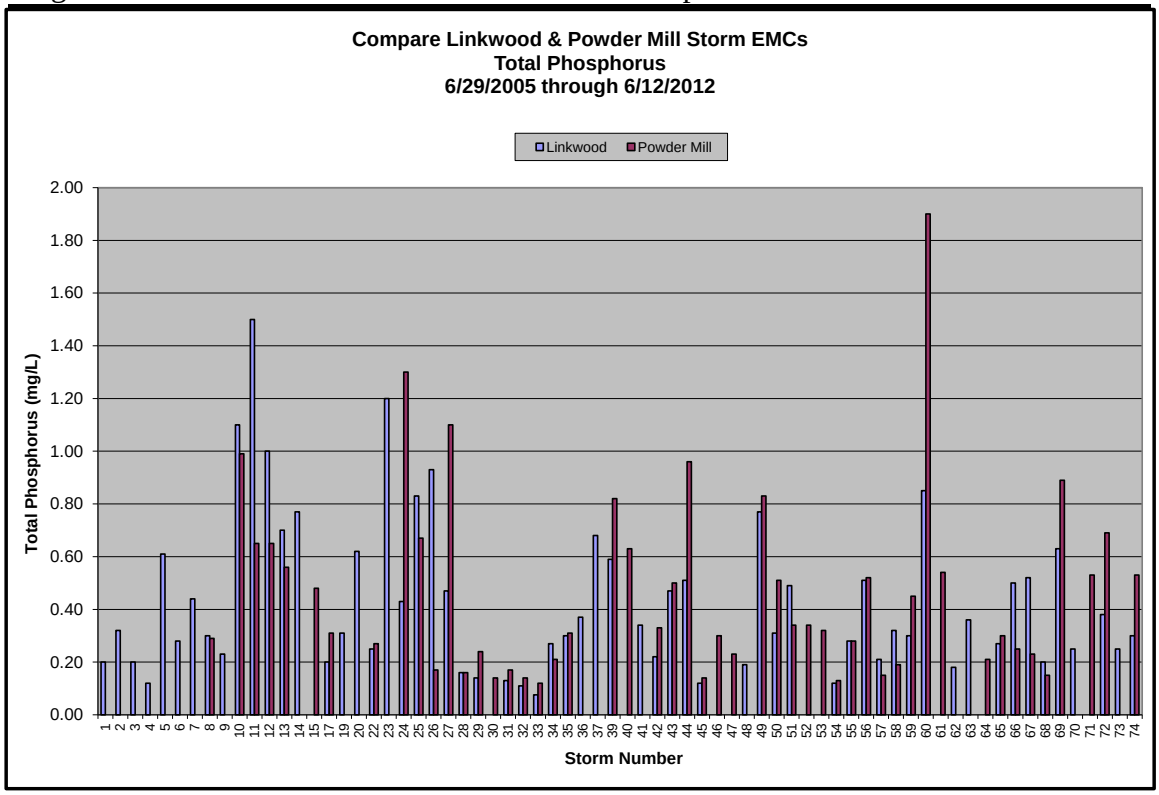


Figure F2c.2 Linkwood & Powder Mill Total Nitrogen Storm EMCs

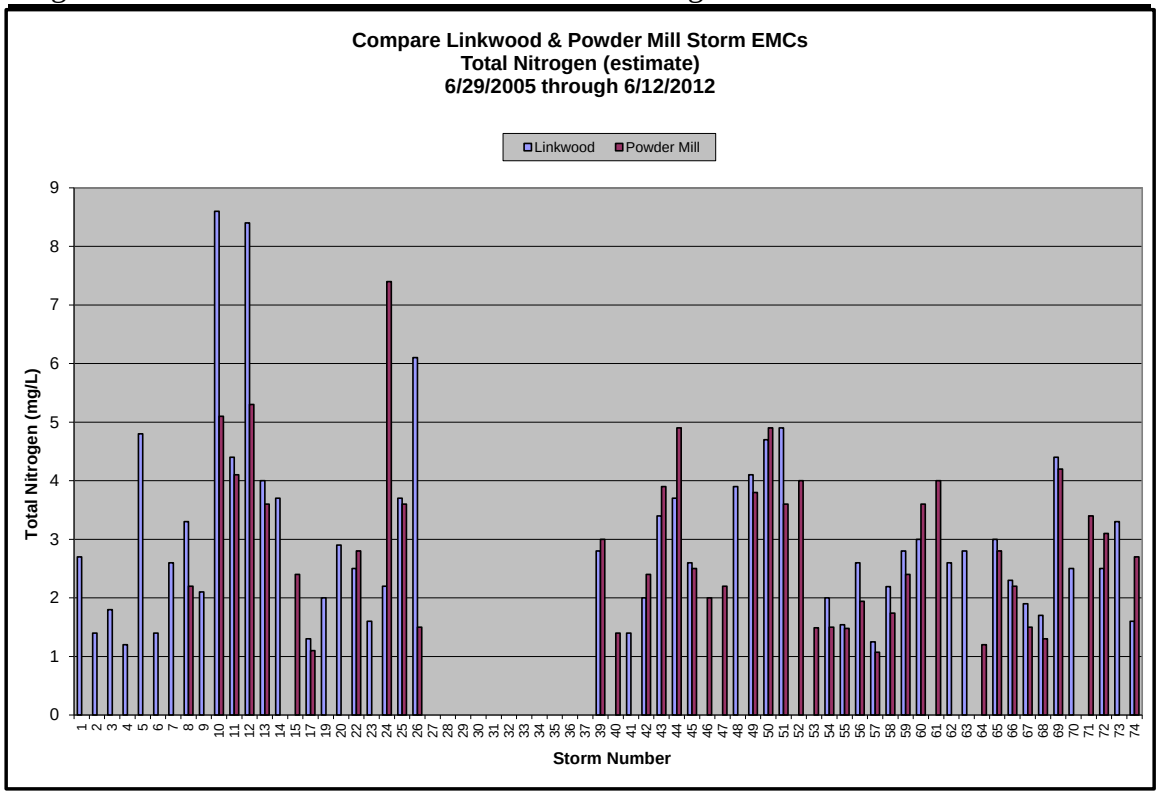


Figure F2c.3 Linkwood & Powder Mill TKN Storm EMCs

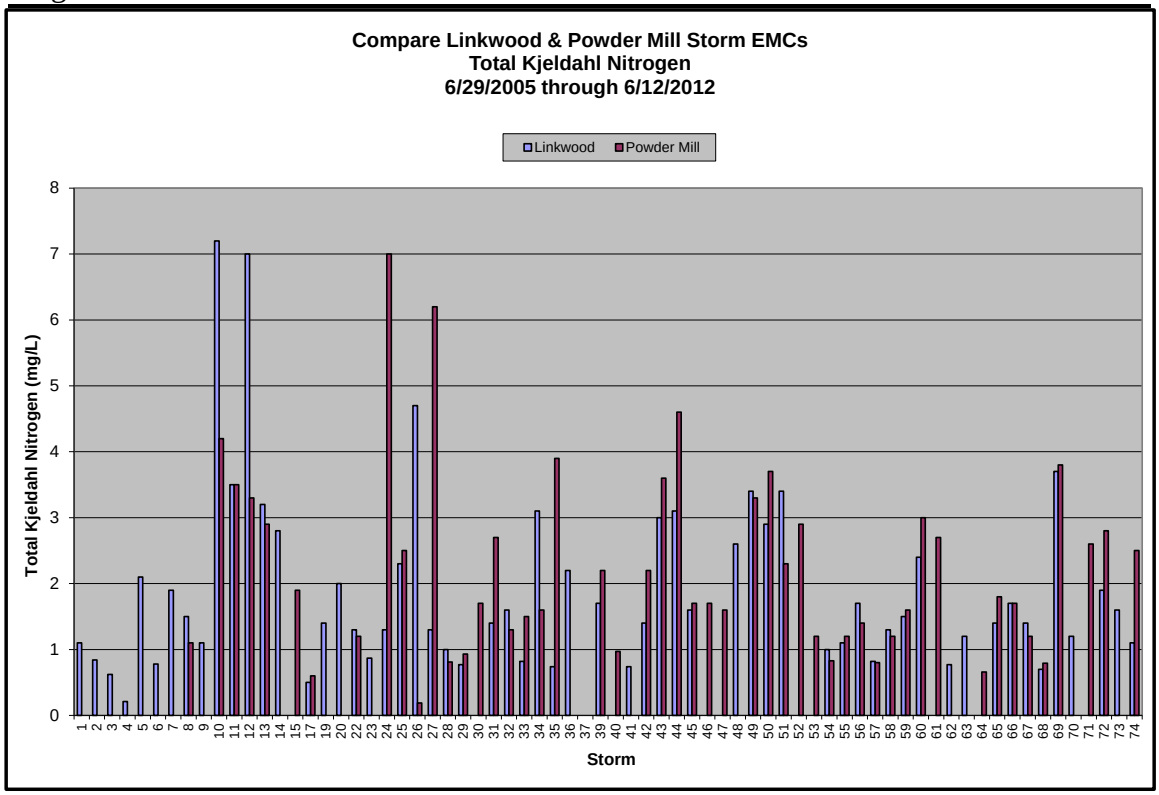


Figure F2c.4 Linkwood & Powder Mill Nitrate+Nitrite Nitrogen Storm EMCs

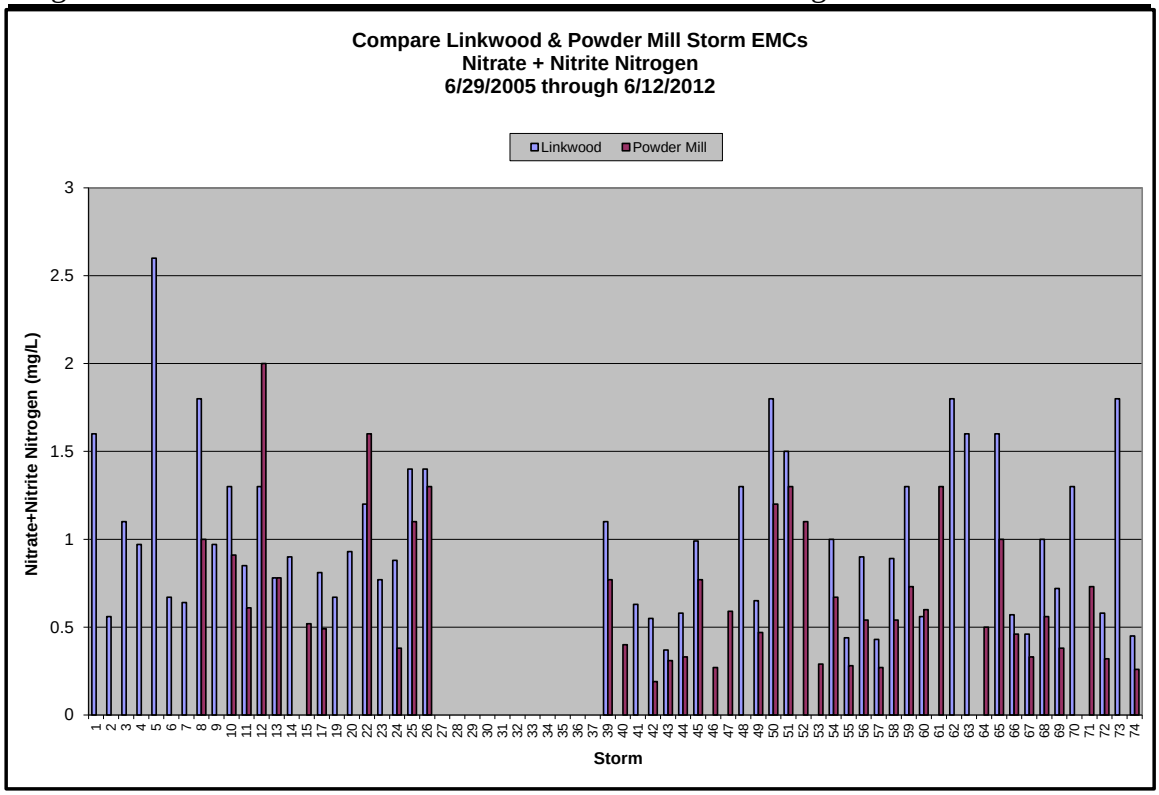


Figure F2c.5 Linkwood & Powder Mill Total Suspended Storm EMCs

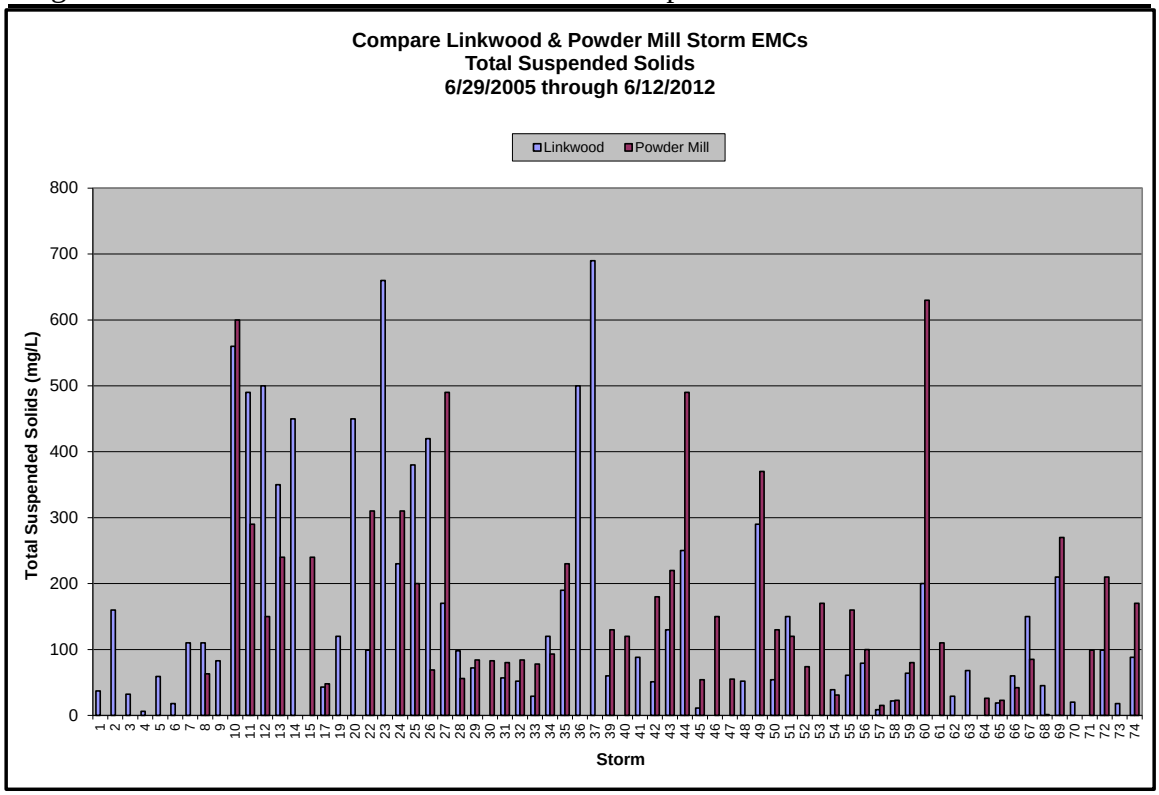
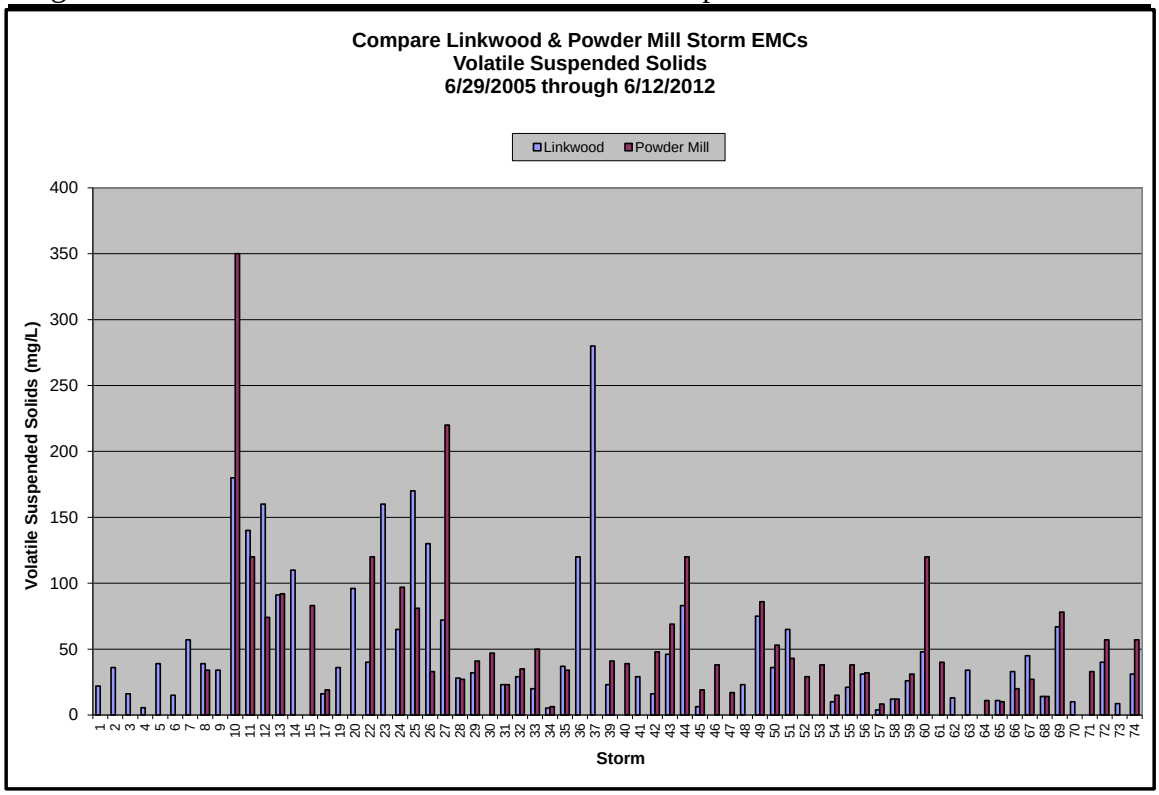


Figure F2c.6 Linkwood & Powder Mill Volatile Suspended Solids Storm EMCs



3. **Annual Reporting**

The 5-year MS4 permit that expired in January 2010 required the City to restore or treat 20% of the City's impervious area, which amounts to 4,675 impervious acres out of a total of 23,373 impervious acres. As a means of measuring how well the practices implemented under the permit have met the goal of treating 20% of the impervious area, the City has estimated the amount of phosphorus annually controlled (retained or removed) by these practices. The State assumes that each acre of impervious surface area generates 2.35 pounds of phosphorus per year. The State set the efficiency for treatment at 40% removal of the phosphorus load, which is 0.94 pounds of phosphorus per year per acre of impervious area. Therefore, the control by a non-traditional practice for each 0.94 pounds of phosphorus is equivalent to the traditional treatment of one acre of impervious area. Thus the goal of treating 20% of the City's impervious area can be described as either the traditional treatment of 4,675 impervious acres or the control of 4,390 pounds of phosphorus per year. Below is a discussion of the SWMD's method of estimating the amount of phosphorus annually retained or removed by each of these groups of practices: street sweeping and inlet cleaning; volume control BMPs; stream restoration; and school and vacant lot greening with asphalt removal.

Street Sweeping and Inlet Cleaning:

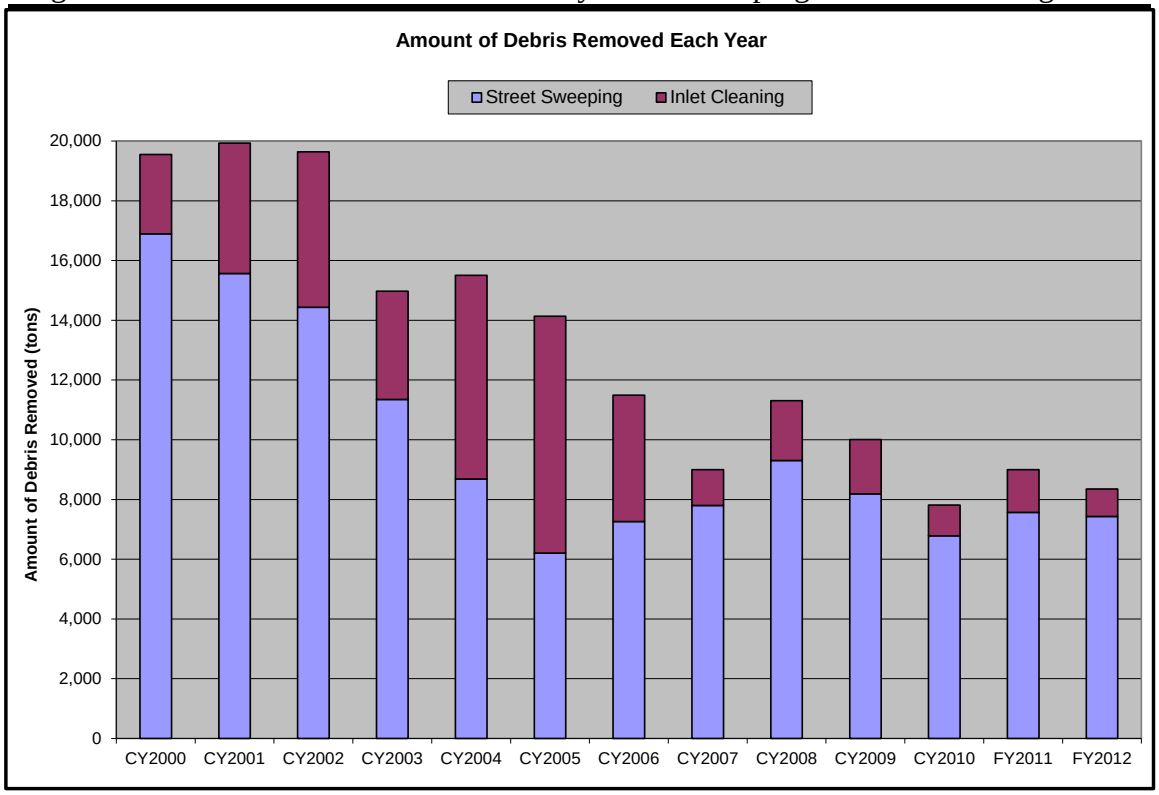
The tonnage of debris collected is multiplied by the median concentration of phosphorus (120 ppm) in the debris collected from the Hamilton Street Sweeping Study to relate the benefit of the City's Street Sweeping and Inlet Cleaning Program to percent impervious area treated. The estimated amount of phosphorus removed by street sweeping and inlet cleaning is converted to an equivalent area of impervious surface treated using the assumptions that the average total phosphorus loading for 1 acre of impervious area is 2.35 pounds per acre per year; and a traditional BMP should remove 40% of the phosphorus. Therefore, each 0.94 pounds of phosphorus controlled by a non-traditional practice is the equivalent of traditional treatment of one acre of impervious surface.

Table F3.1 and Figure F3.1 present the amount of debris removed by street sweeping and inlet cleaning for calendar years 2000 through 2010 and fiscal years 2011 and 2012.

Table F3.1 Conversions of Debris Removed by Street Sweeping & Inlet Cleaning to Equivalent Treated Area

Year	Inlet Cleaning Debris Removed (tons)	Street Sweeping Debris Removed (tons)	Sum of Debris Removed (tons)	Estimated Amount of Total Phosphorus (pounds)	Equivalent Treatment (acres of impervious surface)
CY2000	2,658	16,897	19,555	4,693	4,993
CY2001	4,362	15,569	19,931	4,783	5,089
CY2002	5,204	14,437	19,641	4,714	5,015
CY2003	3,624	11,347	14,971	3,593	3,822
CY2004	6,817	8,686	15,503	3,721	3,958
CY2005	7,925	6,208	14,133	3,392	3,608
CY2006	4,234	7,261	11,495	2,759	2,935
CY2007	1,202	7,800	9,002	2,160	2,298
CY2008	2,001	9,308	11,309	2,714	2,887
CY2009	1,824	8,186	10,010	2,402	2,556
CY2010	1,027	6,783	7,810	1,874	1,994
FY2011	1,431	7,566	8,997	2,159	2,297
FY2012	926	7,429	8,354	2,005	2,133

Figure F3.1 Amount of Debris Removed by Street Sweeping and Inlet Cleaning



Volume Control BMPs:

The volume-control BMPs (see Table F3.2) treat runoff from approximately 1,679 acres, of which, 831 acres are covered with impervious surface. The three completed projects have a combined treatment volume of 13.3 acre-feet. One acre-foot of treatment volume provides the necessary water quality treatment volume of 13.3 acres of impervious area.

Table F3.2 Volume Control BMPs Estimated Annual Phosphorus Removal

Project	Status	Watershed Area (acres)	Impervious Area (acres)	Treatment Volume (acre-feet)	Equivalent Treatment Impervious Area (acre)	Estimated Annual Phosphorus Removal (lbs)
Completed						
Brooklyn Park Stormwater BMP	Completed 2004	306	138	7.5	100	94
Gwynns Run Stormwater BMP	Completed 2003	1,373	693	5.8	77	72
Watershed 263 Six BMPs	Completed 2009			0.037	0.5	0.5
Total Completed		1,679	831	13.3	178	167

Stream Restoration:

In previous annual reports by using phosphorus loading rate reduction as a proxy, the City maintained that each 16.25 feet of the City's stream restoration projects was equivalent to 100% treatment of one acre of impervious surface. This assertion is greatly different from that espoused by the Chesapeake Bay Program. Using phosphorus reduction as a proxy and the efficiencies approved by the Chesapeake Bay Program, each 90 feet of a stream restoration project results in the same amount of phosphorus reduction as achieved using a traditional practice with a 40% treatment on the runoff from one acre of impervious surface. The City will use the equivalency supported by the Chesapeake Bay Program for this report, but may elect in the future to assign a higher phosphorus reduction efficiency to stream restoration. To date the City's stream restoration projects have modified about 13,225 feet, which is equivalent to traditional practices treating 151 acres of impervious surface.

Table F3.3 Stream Restoration Projects

Project	Stream Length (feet)	Phosphorus Reduction (lbs/year)	MS4 Permit Impervious Area Credit Claimed (acres)
Completed			
Biddison Run Phase I	1,500	16.1	17.1
Lower Stony Run	1,850	19.8	21.1
Maidens Choice Stream #1	2,700	28.9	30.7
Middle Stony Run	2,750	29.4	31.3
Upper Stony Run	2,325	24.9	26.5
ER4014 Western Run Stream Restoration Project 1	2,100	22.5	23.9
Total for Completed Projects	**13,225**	**141.5**	**150.5**
Pending (in Design Phase or Out for Bid)			
ER4018 Powder Mill Environmental Restoration Project 1	3,900	41.7	44.4
Open Channel Improvements- East Stony Run	800	8.6	9.1
Lower Lower Stony Run Stream Restoration	5,000	53.5	56.9
Biddison Run Stream Stabilization (Project ER4023)	6,900	73.8	78.5
Total for Completed & Pending Projects	**29,825**	**319.1**	**339.5**

School and Vacant Lot Greening with Asphalt Removal:

The various school and vacant lot greening projects that have been detailed in previous reports have resulted in 18 acres of asphalt removed (see Table F3.4). Note that previously reported pavement removal projects have been solely limited to those projects completed by SWMD.

In the draft guidance document Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, which the Maryland Department of the Environment published in June 2011, impervious surface area removal is considered a land use change. The projects listed in Table F3.4 are considered to have changed the listed amount of acres from impervious to pervious. The guidance document estimates that the practice of converting impervious surface to pervious surface results in a reduction of phosphorus load of 1.47 pounds per acre per year. The guidance document allows an equivalent impervious area treatment credit of 0.62 acres per acre changed from impervious to pervious surface. The projects completed through 2010 have converted 17.65 acres of impervious surface to pervious surface for estimated reduction of 25.9 pounds of phosphorus per year. For the projects listed in Table F3.4, the City is claiming an equivalent treatment credit of 10.9 acres, which is represents 0.05% of the City's total impervious area and 0.23% toward the requirement to treat 20% of the impervious area.

Table F3.4 School and Vacant Lot Greening with Asphalt Removal

Project	Watershed Area (acres)	Percent Impervious	Impervious Area (acres)	Phosphorus Reduction (lbs/year)	MS4 Permit Impervious Area Credit Claimed (acres)
School Greening Phase I	6.75	100%	6.75	9.9	4.2
School Greening Phase II	5.50	100%	5.50	8.1	3.4
School Greening Phase III	4.40	100%	4.40	6.5	2.7
Vacant Lot Greening Phase I	1.00	50%	0.50	0.7	0.3
Yorkwood Elementary School Greening	0.50	100%	0.50	0.7	0.3
Total			**17.65**	**25.9**	**10.9**

Summary of the Estimated Annual Amount of Phosphorus Retained or Removed by the City's BMPs:

Table F3.5 summarizes the estimated amount of phosphorus removed or retained by the City's BMPs that were discussed above. The total estimated annual amount of phosphorus retained by the City's practices that were in place at the time of this report is 2,339 pounds. The permit required the equivalent of treating 20% of the impervious surface area of the City, which is 4,675 acres. The expected amount of phosphorus that 4,675 acres of impervious surface area would generate is 10,986 pounds. Traditional practices are expected to remove 40% of the phosphorus from stormwater; thus the desired phosphorus removal amount for City practices would be 4,395 pounds. The amount controlled by current City practices is only 53% of the goal set by the permit. By this accounting, the City's practices are equivalent to the treatment of only 10.6% of the City's total impervious area by traditional practices. The additional four stream restoration projects listed as pending to which the City has

assigned some value in this calculation will bring the equivalent total to 11.4% of the City's total impervious area by traditional practices. Please note that this calculation only includes the projects discussed in this section. At some point in the near future, the City will finish compiling the database of the stormwater management facilities, and then will know how many impervious acres are treated by these facilities. Also in the future, the City hopes that there will be values to assign to practices such as debris collectors, tree planting, rooftop drain disconnection and other non-traditional stormwater treatment practices.

Table F3.5 Estimated Amount of Phosphorus Retained by Practices and Equivalent Amount of Impervious Area Treatment Claimed

Project Name	Type	Estimated Annual Amount of Phosphorus Withheld (lbs)	MS4 Permit Impervious Area Credit Claimed (acres)
Completed			
Street Sweeping & Inlet Cleaning (FY2012)	cleaning practice	2,005.0	2,133.0
Brooklyn Park Stormwater BMP	volume control	94.0	100.0
Gwynns Run Stormwater BMP	volume control	72.0	76.6
Watershed 263 Six BMPs	volume control	0.5	0.5
Biddison Run Phase I	stream restoration	16.1	17.1
Upper Stony Run	stream restoration	24.9	26.5
Middle Stony Run	stream restoration	29.4	31.3
Maidens Choice Stream #1	stream restoration	28.9	30.7
Lower Stony Run	stream restoration	19.8	21.1
ER4014 Western Run Stream Restoration Project 1	stream restoration	22.5	23.9
School Greening Phase I	asphalt removal	9.9	4.2
School Greening Phase II	asphalt removal	8.1	3.4
School Greening Phase III	asphalt removal	6.5	2.7
Vacant Lot Greening Phase I	asphalt removal	0.7	0.3
Yorkwood Elementary School Greening	asphalt removal	0.7	0.3
Total Completed		**2,338.9**	**2,471.5**
Pending			
ER4018 Powder Mill Environmental Restoration Project 1	stream restoration	41.7	44.4
Open Channel Improvements- East Stony Run	stream restoration	8.6	9.1
Lower Lower Stony Run	stream restoration	53.5	56.9
Biddison Run Stream Stabilization (Project ER4023)	stream restoration	73.8	78.5
Total Completed & Pending		**2,516.5**	**2,660.5**

G. Assessment of Controls

1. Watershed Restoration Assessment

a. Chemical Monitoring

Moores Run Long-term Discharge Characterization

Table G1a.1 shows the number of sampling events, the number of samples collected, and the number of water quality analyses performed for monitoring associated with the long-term discharge characterization for the Moores Run during Fiscal Year 2011 (July 2010 through June 2011). There were seven storm events that were monitored at the Radecke Avenue station and six that were successfully monitored at the Hamilton Avenue station. There were ten baseline monitoring events at these stations.

Table G1a.1 Chemical Monitoring for Moores Run Long-term Discharge Characterization During Fiscal Year 2011 (7/1/2010 to 6/30/2011)

Station and Type	Number of Surveys or Storm Events	Number of Samples	Number of Water Quality Analyses Performed
Mary Ave. Baseline	10	10	201
Hamilton Ave. Baseline	10	10	201
Radecke Ave. Baseline	10	10	211
Hamilton Ave. Ammonia Screening	22	22	132
Radecke Ave. Ammonia Screening	22	22	132
Hamilton Storm	6	44	660
Radecke Storm	7	48	759
Total			2,296

Table G1a.2 shows the number of sampling events, the number of samples collected, and the number of water quality analyses performed for monitoring associated with the long-term discharge characterization for the Moores Run during Fiscal Year 2012 (July 2011 through June 2012). There were twelve storm events that were monitored at the Radecke Avenue station and eight that were successfully monitored at the Hamilton Avenue station. There were twelve baseline monitoring events at these stations.

Table G1a.2 Chemical Monitoring for Moores Run Long-term Discharge Characterization During Fiscal Year 2012 (7/1/2011 to 6/30/2012)

Station and Type	Number of Surveys or Storm Events	Number of Samples	Number of Water Quality Analyses Performed
Mary Ave. Baseline	12	12	251
Hamilton Ave. Baseline	12	12	251
Radecke Ave. Baseline	12	12	261
Hamilton Ave. Ammonia Screening	29	29	168
Radecke Ave. Ammonia Screening	29	29	168
Hamilton Storm	8	42	635
Radecke Storm	12	65	1,034
Total			2,768

The storm EMCs and baseline sampling results for Radecke Avenue and Hamilton Avenue from January 2011 through June 2012 can be found in table "Baltimore City Chemical Monitoring Jan 2011 Jun 2012" in the Access database "Baltimore City NPDES Stormwater Permit Data Jan 2011 Jun 2012.mdb" on the CD-ROM accompanying this report. The results for all the discrete samples from all monitoring at these two stations from January 2011 through June 2012 can be found in table "Baltimore City Monitoring Sample Results Jan 2011 Jun 2012" in that Access database. A list of sampling activities from January 2011 through June 2012 at the Hamilton Avenue can be found in Table G1a.3. A list of sampling activities from January 2011 through June 2012 at the Radecke Avenue station can be found in Table G1a.4.

Total Petroleum Hydrocarbons (TPH)

The City uses automated samplers to collect samples during storms at the Hamilton Avenue and Radecke Avenue monitoring stations. In order to analyze storm samples for TPH, the samples must be collected manually, and preserved immediately. This incurs a great expense in overtime wages. The City did not have personnel manning these stations during any of the storm events monitored from January 2011 through June 2012. Thus, no TPH analyses were run on storm samples from January 2011 through June 2012.

Water Temperature and pH

The automated sampling equipment installed at the Hamilton Avenue station is capable of operating pH and water temperature sensors; however, the City did not collect pH or water temperature data during

any of the storm events successfully monitored at the Hamilton Avenue station from January 2011 through June 2012. The equipment used at the Radecke Avenue station cannot operate pH or water temperature sensors.

Table G1a.3 Summary of Monitoring Activities for Hamilton Avenue from January 2011 through June 2012	
First Quarter Calendar Year 2011 (Third Quarter Fiscal Year 2011)	
1/19/2011	Visited site as part of Herring Run Ammonia Screening
1/31/2011	Scheduled baseline sampling was canceled because of too much snow remaining from storm on January 26th; thus no baseline sample for January
2/3/2011	Visited site as part of Herring Run Ammonia Screening
2/10/2011	Visited site as part of Herring Run Ammonia Screening
2/17/2011	Visited site as part of Herring Run Ammonia Screening
2/25/2011	Unsuccessful storm sampling: water level sensor did not operate properly, consequently automated sampler did not initiate until late in the storm
3/1/2011	Collected 1 grab baseline sample
3/10/2011	Successful storm sampling- designated Event ID 204; submitted 8 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data
3/11/2011	Visited site as part of Herring Run Ammonia Screening
3/17/2011	Visited site as part of Herring Run Ammonia Screening
3/24/2011	Visited site as part of Herring Run Ammonia Screening; precipitation that day
3/28/2011	Collected 1 grab baseline sample
Second Quarter Calendar Year 2011 (Fourth Quarter Fiscal Year 2011)	
4/7/2011	Visited site as part of Herring Run Ammonia Screening
4/20/2011	Visited site as part of Herring Run Ammonia Screening
4/27/2011	Collected 1 grab baseline sample
5/18/2011	Visited site as part of Herring Run Ammonia Screening; precipitation that day
5/23/2011	Collected 1 grab baseline sample
6/3/2011	Visited site as part of Herring Run Ammonia Screening
6/23/2011	Visited site as part of Herring Run Ammonia Screening
6/27/2011	Collected 1 grab baseline sample
Third Quarter Calendar Year 2011 (First Quarter Fiscal Year 2012)	
7/7/2011	Visited site as part of Herring Run Ammonia Screening
7/14/2011	Visited site as part of Herring Run Ammonia Screening
7/25/2011	Collected 1 grab baseline sample
8/2/2011	Successful storm sampling- designated Event ID 205; submitted 3 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data
8/3/2011	Visited site as part of Herring Run Ammonia Screening; precipitation that day
8/11/2011	Visited site as part of Herring Run Ammonia Screening
8/22/2011	Collected 1 grab baseline sample
9/9/2011	Visited site as part of Herring Run Ammonia Screening; precipitation that day
9/15/2011	Visited site as part of Herring Run Ammonia Screening
9/22/2011	Visited site as part of Herring Run Ammonia Screening
9/26/2011	Collected 1 grab baseline sample
9/28/2011	Successful storm sampling- designated Event ID 206; submitted 5 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data

Table G1a.3 Summary of Monitoring Activities for Hamilton Avenue from January 2011 through June 2012 (continued)	
Fourth Quarter Calendar Year 2011 (Second Quarter Fiscal Year 2012)	
10/5/2011	Visited site as part of Herring Run Ammonia Screening
10/12/2011	Successful storm sampling- designated Event ID 207; submitted 5 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data; last sample collected/analyzed taken just after 2nd (lesser) peak; water level sensor data from sensor working with the automated sampler needed to be adjusted (raised) to match USGS meter's data
10/19/2011	Unsuccessful storm sampling: equipment did not operate properly
10/21/2011	Visited site as part of Herring Run Ammonia Screening
10/24/2011	Collected 1 grab baseline sample
11/3/2011	Visited site as part of Herring Run Ammonia Screening
11/8/2011	Visited site as part of Herring Run Ammonia Screening
11/16/2011	Successful storm sampling; rain came in two waves separated by about 8 hours; decided to treat as two storms and designated them as Event ID 209 and Event ID 210; submitted 3 storm samples for lab analysis from first event; no samples collected during second event; did not analyze for TPH; did not collect pH or water temperature data
11/17/2011	Visited site as part of Herring Run Ammonia Screening
11/28/2011	Collected 1 grab baseline sample
12/6/2011	Visited site as part of Herring Run Ammonia Screening; precipitation that day
12/7/2011	Successful storm sampling- designated Event ID 211; submitted 7 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data
12/14/2011	Visited site as part of Herring Run Ammonia Screening
12/19/2011	Collected 1 grab baseline sample
First Quarter Calendar Year 2012 (Third Quarter Fiscal Year 2012)	
1/12/2012	Visited site as part of Herring Run Ammonia Screening; precipitation that day
1/24/2012	Visited site as part of Herring Run Ammonia Screening
1/30/2012	Collected 1 grab baseline sample
2/7/2012	Visited site as part of Herring Run Ammonia Screening
2/15/2012	Visited site as part of Herring Run Ammonia Screening
2/22/2012	Visited site as part of Herring Run Ammonia Screening
2/27/2012	Collected 1 grab baseline sample
2/29/2012	Successful storm sampling- designated Event ID 212; submitted 6 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data
3/7/2012	Visited site as part of Herring Run Ammonia Screening
3/15/2012	Visited site as part of Herring Run Ammonia Screening
3/26/2012	Collected 1 grab baseline sample
Second Quarter Calendar Year 2012 (Fourth Quarter Fiscal Year 2012)	
4/12/2012	Visited site as part of Herring Run Ammonia Screening
4/19/2012	Visited site as part of Herring Run Ammonia Screening
4/23/2012	Scheduled baseline sampling. Collected 1 grab sample. It rained near or at the time of sampling. Coded sample in the database to indicate rain influence.
4/26/2012	Successful storm sampling- designated Event ID 213; submitted 5 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data
5/2/2012	Visited site as part of Herring Run Ammonia Screening
5/10/2012	Visited site as part of Herring Run Ammonia Screening
5/15/2012	Unsuccessful storm sampling: no samples collected for this small event

Table G1a.3 Summary of Monitoring Activities for Hamilton Avenue from January 2011 through June 2012 (continued)	
Second Quarter Calendar Year 2012 (Fourth Quarter Fiscal Year 2012) (continued)	
5/21/2012	Scheduled baseline sampling. Collected 1 grab sample. It rained near or at the time of sampling. Coded sample in the database to indicate rain influence.
6/1/2012	Visited site as part of Herring Run Ammonia Screening
6/5/2012	Visited site as part of Herring Run Ammonia Screening
6/12/2012	Unsuccessful storm sampling: no samples collected because stream did not rise high enough to trigger sampler; first of two events this date- second event was large enough to sample
6/12/2012	Successful storm sampling- designated Event ID 216; submitted 8 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data; second of two events on this date- previous event was not large enough to trigger sampler
6/14/2012	Visited site as part of Herring Run Ammonia Screening
6/22/2012	Visited site as part of Herring Run Ammonia Screening
6/25/2012	Collected 1 grab baseline sample

Table G1a.4 Summary of Monitoring Activities for Radecke Avenue from January 2011 through June 2012	
First Quarter Calendar Year 2011 (Third Quarter Fiscal Year 2011)	
1/19/2011	Visited site as part of Herring Run Ammonia Screening
1/31/2011	Scheduled baseline sampling was canceled because of too much snow remaining from storm on January 26th; thus no baseline sample for January
2/3/2011	Visited site as part of Herring Run Ammonia Screening
2/10/2011	Visited site as part of Herring Run Ammonia Screening
2/17/2011	Visited site as part of Herring Run Ammonia Screening
2/25/2011	Successful storm sampling- designated Event ID 203; submitted 4 storm samples for lab analysis; samples analyzed for sodium; did not analyze for TPH; did not collect pH or water temperature data
3/1/2011	Collected 1 grab baseline sample
3/10/2011	Successful storm sampling- designated Event ID 204; submitted 7 storm samples for lab analysis; samples analyzed for sodium; did not analyze for TPH; did not collect pH or water temperature data
3/11/2011	Visited site as part of Herring Run Ammonia Screening
3/17/2011	Visited site as part of Herring Run Ammonia Screening
3/24/2011	Visited site as part of Herring Run Ammonia Screening; precipitation that day
3/28/2011	Collected 1 grab baseline sample
Second Quarter Calendar Year 2011 (Fourth Quarter Fiscal Year 2011)	
4/7/2011	Visited site as part of Herring Run Ammonia Screening
4/20/2011	Visited site as part of Herring Run Ammonia Screening
4/27/2011	Collected 1 grab baseline sample
5/18/2011	Visited site as part of Herring Run Ammonia Screening; precipitation that day
5/23/2011	Collected 1 grab baseline sample
6/3/2011	Visited site as part of Herring Run Ammonia Screening
6/23/2011	Visited site as part of Herring Run Ammonia Screening
6/27/2011	Collected 1 grab baseline sample
Third Quarter Calendar Year 2011 (First Quarter Fiscal Year 2012)	
7/7/2011	Visited site as part of Herring Run Ammonia Screening
7/14/2011	Visited site as part of Herring Run Ammonia Screening
7/25/2011	Collected 1 grab baseline sample
8/2/2011	Successful storm sampling- designated Event ID 205; submitted 6 storm samples for lab analysis; samples analyzed for sodium; did not analyze for TPH; did not collect pH or water temperature data

Table G1a.4 Summary of Monitoring Activities for Radecke Avenue from January 2011 through June 2012 (continued)	
Third Quarter Calendar Year 2011 (First Quarter Fiscal Year 2012) (continued)	
8/3/2011	Visited site as part of Herring Run Ammonia Screening; precipitation that day
8/11/2011	Visited site as part of Herring Run Ammonia Screening
8/22/2011	Collected 1 grab baseline sample
9/9/2011	Visited site as part of Herring Run Ammonia Screening; precipitation that day
9/15/2011	Visited site as part of Herring Run Ammonia Screening
9/22/2011	Visited site as part of Herring Run Ammonia Screening
9/26/2011	Collected 1 grab baseline sample
9/28/2011	Successful storm sampling- designated Event ID 206; submitted 7 storm samples for lab analysis; samples analyzed for sodium; did not analyze for TPH; did not collect pH or water temperature data
Fourth Quarter Calendar Year 2011 (Second Quarter Fiscal Year 2012)	
10/5/2011	Visited site as part of Herring Run Ammonia Screening
10/12/2011	Successful storm sampling- designated Event ID 207; submitted 4 storm samples for lab analysis; samples analyzed for sodium; did not analyze for TPH; did not collect pH or water temperature data
10/19/2011	Successful storm sampling- designated Event ID 208; submitted 5 storm samples for lab analysis; samples analyzed for sodium; did not analyze for TPH; did not collect pH or water temperature data
10/21/2011	Visited site as part of Herring Run Ammonia Screening
10/24/2011	Collected 1 grab baseline sample
11/3/2011	Visited site as part of Herring Run Ammonia Screening
11/8/2011	Visited site as part of Herring Run Ammonia Screening
11/16/2011	Successful storm sampling; rain came in two waves separated by about 8 hours; decided to treat as two storms and designated them as Event ID 209 and Event ID 210; submitted 4 storm samples for lab analysis from first event and 3 samples from second event; samples analyzed for sodium; did not analyze for TPH; did not collect pH or water temperature data
11/17/2011	Visited site as part of Herring Run Ammonia Screening
11/28/2011	Collected 1 grab baseline sample
12/6/2011	Visited site as part of Herring Run Ammonia Screening; precipitation that day
12/7/2011	Successful storm sampling- designated Event ID 211; last sample collected was shortly after the peak- not very far down the descending limb; submitted 7 storm samples for lab analysis; samples analyzed for sodium; did not analyze for TPH; did not collect pH or water temperature data
12/14/2011	Visited site as part of Herring Run Ammonia Screening
12/19/2011	Collected 1 grab baseline sample
First Quarter Calendar Year 2012 (Third Quarter Fiscal Year 2012)	
1/12/2012	Visited site as part of Herring Run Ammonia Screening; precipitation that day
1/24/2012	Visited site as part of Herring Run Ammonia Screening
1/30/2012	Collected 1 grab baseline sample
2/7/2012	Visited site as part of Herring Run Ammonia Screening
2/15/2012	Visited site as part of Herring Run Ammonia Screening
2/22/2012	Visited site as part of Herring Run Ammonia Screening
2/27/2012	Collected 1 grab baseline sample
2/29/2012	Successful storm sampling- designated Event ID 212; submitted 6 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data
3/7/2012	Visited site as part of Herring Run Ammonia Screening
3/15/2012	Visited site as part of Herring Run Ammonia Screening
3/26/2012	Collected 1 grab baseline sample

Table G1a.4 Summary of Monitoring Activities for Radecke Avenue from January 2011 through June 2012 (continued)	
Second Quarter Calendar Year 2012 (Fourth Quarter Fiscal Year 2012)	
4/12/2012	Visited site as part of Herring Run Ammonia Screening
4/19/2012	Visited site as part of Herring Run Ammonia Screening
4/23/2012	Scheduled baseline sampling. Collected 1 grab sample. It rained near or at the time of sampling. Coded sample in the database to indicate rain influence.
4/26/2012	Successful storm sampling- designated Event ID 213; submitted 6 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data
5/2/2012	Visited site as part of Herring Run Ammonia Screening
5/10/2012	Visited site as part of Herring Run Ammonia Screening
5/15/2012	Successful storm sampling- designated Event ID 214; submitted 6 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data; used rainfall data from Herring Run at Route 40 gage because Mount Pleasant gage onlt recorded 1 bucket tip
5/21/2012	Scheduled baseline sampling. Collected 1 grab sample. It rained near or at the time of sampling. Coded sample in the database to indicate rain influence.
6/1/2012	Visited site as part of Herring Run Ammonia Screening
6/5/2012	Visited site as part of Herring Run Ammonia Screening
6/12/2012	Successful storm sampling- designated Event ID 215; submitted 6 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data; first of two events sampled on this date
6/12/2012	Successful storm sampling- designated Event ID 216; submitted 6 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data; second of two events sampled on this date
6/14/2012	Visited site as part of Herring Run Ammonia Screening
6/22/2012	Visited site as part of Herring Run Ammonia Screening
6/25/2012	Collected 1 grab baseline sample

Moores Run SWMM Model Results

SWMD did not compute pollution load estimates using the SWMM model for monitoring data collected during January 2011 through June 2012. Please see the 2010 Annual Report for SWMM estimates for 1999, and 2003 through 2009.

Moores Run Trends Analyses

In order to look for trends over time, scatterplot graphs of the storm EMCs from monitoring at Hamilton Avenue and Radecke Avenue from May 1995 through September 2012 were made for the following parameters: total nitrogen, nitrate+nitrite nitrogen, TKN, total phosphorus, total copper, dissolved copper, total lead, dissolved lead, total zinc, dissolved zinc, fecal coliform counts, e. coli counts (begun 9/25/2008), enterococci counts (begun 9/25/2008), suspended solids, volatile suspended solids (begun 2/10/2005) and BOD. Copies of the graphs of all the parameters can be found in the Excel file "Hamilton & Radecke Stm EMC Time Graphs.xls" on the CD-ROM accompanying this report. Please note that there was no storm monitoring at Hamilton Avenue from August 2004 through October 2005 while there was utilities renovation (construction) in the area- including the building of the Hamilton Avenue monitoring station.

In addition to Hamilton Avenue and Radecke Avenue, there are two other dry weather monitoring stations in the Moores Run. The samples at the Mary Avenue station are collected underground in the storm drain network. The flow from the Mary Avenue station, like that from the Hamilton Avenue station, contributes to the flow at Radecke Avenue. The other dry weather monitoring station is Biddle St. & 62nd St., which is well downstream of the Radecke Avenue station and near to where the Moores Run crosses the City line. Scatterplot graphs of dry weather samples collected at the monitoring stations in the Moores Run were also made. These graphs can be found in the folder "City Streams Dry Weather Time Concentration Graphs" on the CD-ROM accompanying this report.

Moores Run E. Coli MPN Count Analysis

Table E2.1 lists the e. coli MPN count geometric mean and percentage of sample counts which were at or below each of the State's water use contact rules for the dry weather samples collected at the Hamilton Ave. and Radecke Ave. stations between November 2008 and December 2012. These metrics point to poor water quality in terms of bacteria. The storm event mean concentration (EMC) for the e. coli MPN counts are much higher generally by one order of magnitude.

Moores Run Total Phosphorus and Total Nitrogen Analyses

Table E2.3 listed the percentage of dry weather samples at Hamilton Avenue between January 2009 and December 2012 that were at or exceeded the total phosphorus guideline of 0.1 mg/L as 45%, which rates in the "high" range. The percentage of dry weather samples at Hamilton Avenue that were at or exceeded the total nitrogen guideline of 3 mg/L was 25%, which is in the "elevated" range. The percentages for the dry weather samples from the Radecke Avenue station were 33% at or exceeding the total phosphorus guideline, which is in the "high" range and 13% at or exceeding the total nitrogen guideline, which rates in the "elevated" range.

Moores Run Storm Sample Total and Volatile Suspended Solids Analysis

Starting with the storm on February 10, 2005, the City began analyzing the discrete storm samples collected at the Radecke Avenue and Hamilton Avenue stations for volatile suspended solids. Figure G1a.1 presents a comparison of the storm EMCs for total suspended solids and volatile suspended solids from the Hamilton Avenue and Radecke Avenue stations from February 2005 through June 2012. For those storms when both stations were successfully sampled, the total suspended solids EMCs and volatile suspended solids EMCs for the

Hamilton Avenue and Radecke Avenue stations track well together (see Figure G1a.2).

Figure G1a.1 Comparison of Storm EMCs for Total & Volatile Suspended Solids from the Hamilton Avenue & Radecke Avenue Stations

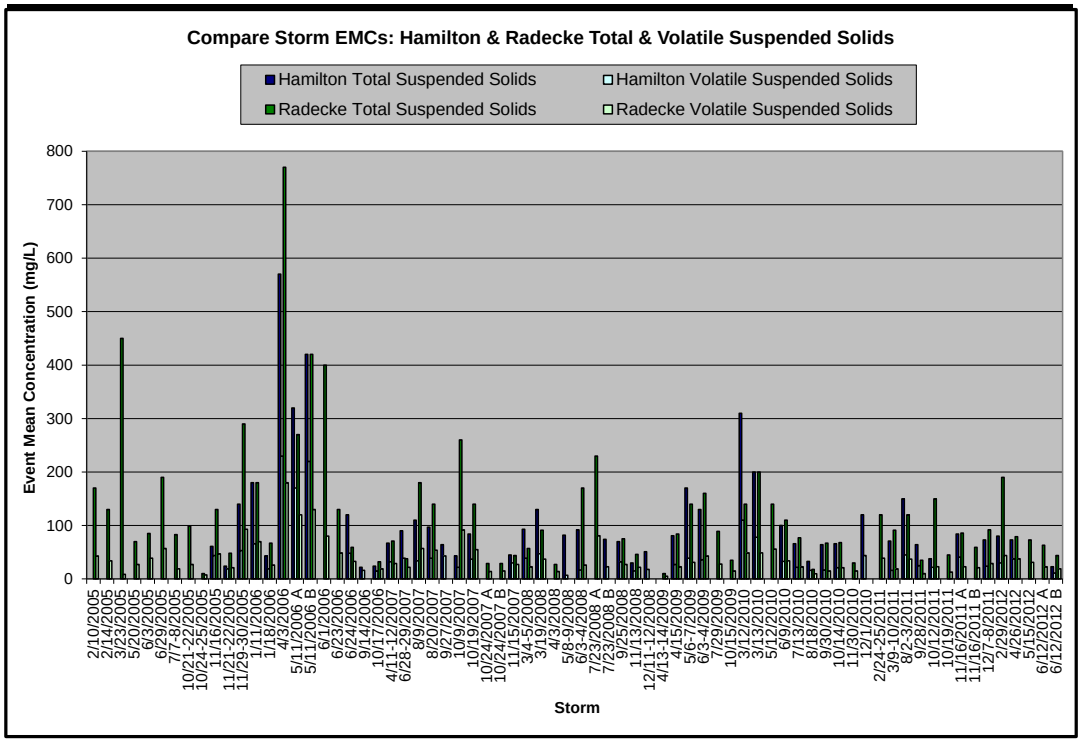
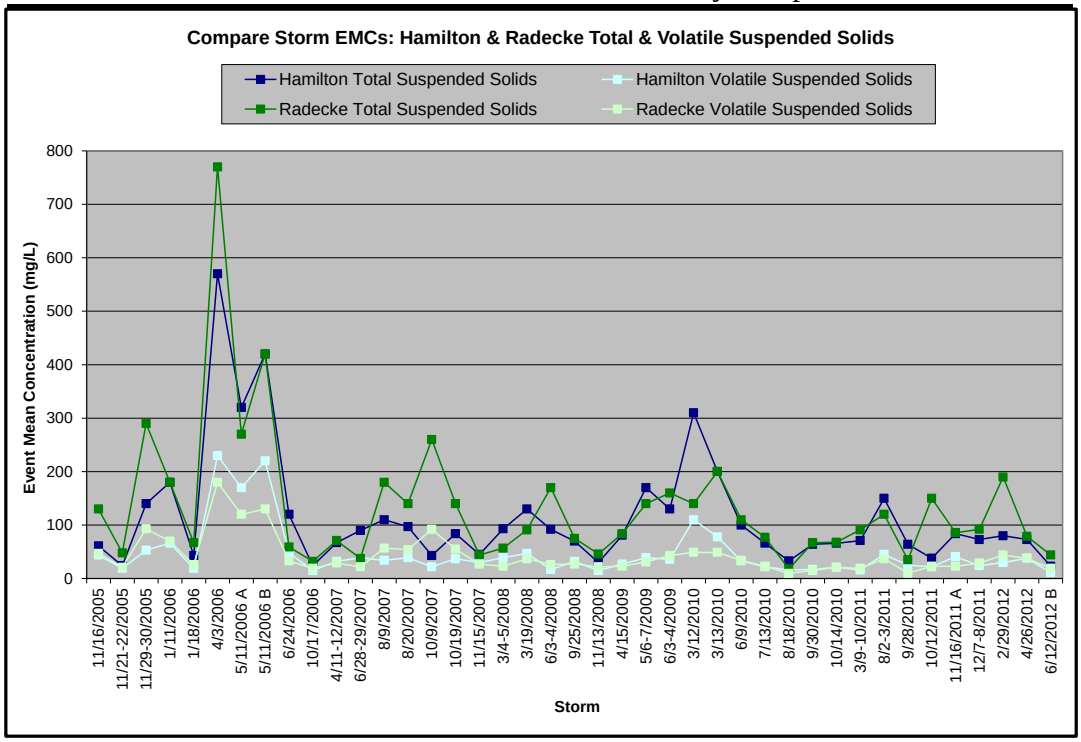


Figure G1a.2 Comparison of Storm EMCs for Total & Volatile Suspended Solids from the Hamilton Avenue & Radecke Avenue Stations When Both Stations Were Successfully Sampled



b. **Moores Run Biological Monitoring**

SWMD collects benthic macroinvertebrate samples each year in the Moores Run. Samples have been collected at up to four fixed stations: #1367 (previously referred to as BCY119), #1392 (previously referred to as MR03), #1634 (previously referred to as HAMT02) and #1659 (previously referred to as HAMT01). The BIBI scores for samples collected at these stations from 2002 through 2012 are listed in Table E3.1. The BIBI scores for stations #1367 and #1659 for 2002 through 2012 are also presented in the graph in Figure E3.7. Each time stations #1367 and #1659 have been sampled, the BIBI score has rated in the "very poor" range.

c. **Physical Monitoring**

i. Geomorphologic Stream Assessment of Moores Run

The City did not conduct a hydrogeomorphological assessment of the Moores Run during January 2011 through June 2012.

ii. Stream Habitat Assessment

SWMD performed a habitat assessment survey of the upper Moores Run watershed on June 28, 2012. The watershed is located in a highly residential area. The survey area covered

Moores Run from the quadruple cell outfall at Hamilton Avenue to Radecke Avenue. The watershed survey also included the Moores Run tributary at Todd Avenue. This survey followed the protocols set forth in the Stream Habitat Assessment section in the Maryland Biological Stream Survey Sampling Manual, February 2001, which instructs surveyors to note the following parameters: instream habitat, epifaunal substrate, velocity/depth diversity, pool/glide/eddy quality, riffle/run quality, embeddedness, shading and trash rating. Additional parameters used in this survey were channel alteration, bank vegetative protection, condition of banks and riparian vegetative zone. Each habitat parameter, except percent embeddedness, was rated with a numerical score. Each score was ranked in one of four categories. The categories from best to worst are optimal, suboptimal, marginal and poor.

Tables G1cii.1 and G1cii.2 show a comparison of the scores from the surveys done for the following reports:

- 2004 Annual Report (May 18, 2005);
- 2005 Annual Report (May 1, 2006);
- 2006 Annual Report (April 2, 2007);
- 2007 Annual Report (May 5, 2008);
- 2008 Annual Report (April 30, 2009);
- 2009 Annual Report (March 24, 2010);
- 2010 Annual Report (March 3, 2011); and
- This report (June 28, 2012).

The percent shading data was excluded from Tables G1cii.1 and G1cii.2 since all of the surveys from 2005 through 2011 were conducted between March and May, and the leaves would probably not have reached their full growth at the time of those past surveys.

Figure G1cii.1 Moores Run Habitat Assessment Scores 2005-2012 (Part I)

	Moores Run above Radecke Ave. Segments											
	1	2	3	4	5	6	7	8	9	10	11	Tributary
Parameter												
Instream Habitat												
2005	16	16	16	4	16	16	16	16	13	16	1	13
2006	15	16	15	4	15	15	15	14	13	14	1	13
2007	15	14	16	4	15	11	15	14	13	15	1	15
2008	15	15	17	4	15	11	11	15	14	14	1	12
2009	12	14	13	13	13	15	15	15	13	15	3	10
2010	16	16	18	5	12	17	16	16	13	15	1	15
2011	17	18	18	6	17	14	14	16	15	15	1	14
2012	18	16	18	5	15	11	11	10	10	15	2	13
Epifaunal Substrate												
2005	16	16	16	1	16	16	15	16	13	16	1	14
2006	14	15	15	4	15	15	14	14	10	14	0	14
2007	15	14	15	5	15	10	12	10	10	14	0	10
2008	14	14	17	4	14	10	8	12	11	14	0	12
2009	10	12	11	11	11	15	13	14	13	15	10	7
2010	15	14	17	8	11	12	14	11	11	10	7	15
2011	16	17	17	8	16	14	13	9	12	10	6	13
2012	12	15	15	8	14	10	14	9	9	10	6	13
Velocity/Depth Diversity												
2005	8	10	14	6	8	8	8	10	8	9	11	8
2006	8	10	10	6	11	8	8	11	10	10	6	8
2007	10	13	12	6	6	8	8	10	9	10	6	10
2008	8	12	15	6	11	9	9	12	8	9	6	8
2009	11	11	13	8	10	15	14	15	13	15	2	10
2010	10	15	14	8	10	11	13	8	12	10	11	15
2011	10	10	10	11	10	10	14	15	15	10	12	10
2012	7	14	10	6	10	8	8	13	9	10	1	11
Pool/Glide/Eddy Quality												
2005	5	7	12	13	10	8	10	15	12	3	13	1
2006	5	7	10	16	10	8	10	11	12	3	8	1
2007	5	7	11	16	11	10	9	10	11	4	10	1
2008	8	14	12	17	12	12	10	14	13	3	8	1
2009	9	10	13	12	7	9	13	12	11	11	13	5
2010	8	12	12	13	11	8	13	10	11	9	13	3
2011	14	14	13	17	14	13	14	15	15	13	15	3
2012	8	16	6	15	8	7	8	13	10	11	8	11
Riffle/Run Quality												
2005	11	13	11	3	12	12	13	14	10	14	2	7
2006	11	13	11	2	11	13	13	14	12	14	2	7
2007	13	15	13	2	13	13	12	14	13	15	0	8
2008	13	13	13	1	15	15	14	14	13	13	1	6
2009	18	12	15	1	6	13	16	15	8	11	1	8
2010	12	12	13	1	13	13	13	13	11	10	2	9
2011	15	17	18	14	17	13	15	15	15	15	1	11
2012	10	14	15	0	15	10	11	12	10	12	0	7
Embeddedness (%)												
2005	50	50	50	0	60	70	50	50	70	50	0	50
2006	50	50	50	0	60	60	60	60	60	50	0	50
2007	60	60	50	75	60	60	60	50	60	50	0	50
2008	40	50	50	0	50	60	50	50	50	50	0	50
2009	10	50	50	70	50	30	20	20	30	20	0	70
2010	40	40	40	0	40	30	30	30	40	40	0	40
2011	50	50	50	50	50	60	50	50	50	50	0	50
2012	30	30	30	0	50	50	30	50	50	20	0	30

Scoring Color Code		
Score	Category	Color Code
16 to 20	optimal	
11 to 15	suboptinal	
6 to 10	marginal	
0 to 5	poor	

Figure G1cii.2 Moores Run Habitat Assessment Scores 2005-2012 (Part II)

	Moores Run above Radecke Ave. Segments											
	1	2	3	4	5	6	7	8	9	10	11	Tributary
Parameter												
Embeddedness												
2005	11	11	11	0	9	7	11	11	7	11	0	11
2006	12	11	11	0	9	9	10	10	10	11	0	11
2007	10	10	11	3	10	9	10	11	10	11	0	13
2008	13	13	13	0	13	8	13	13	13	13	0	12
2009	19	11	12	7	11	14	16	16	14	17	0	7
2010	14	14	14	0	14	14	13	14	13	13	0	14
2011	14	14	14	14	14	9	14	14	14	14	0	14
2012	14	14	14	0	11	10	14	10	10	17	0	14
Trash Rating												
2005	11	8	4	8	9	8	11	7	5	7	9	11
2006	8	11	11	10	10	11	8	12	3	9	18	11
2007	8	8	7	12	11	10	9	10	5	10	18	15
2008	8	8	3	8	6	6	5	5	3	8	18	13
2009	8	8	3	9	9	8	9	8	8	10	13	6
2010	8	8	3	8	13	8	8	10	7	11	12	13
2011	6	6	8	6	13	9	10	6	7	12	18	8
2012	8	6	7	3	13	13	10	13	12	11	16	14
Channel Alteration												
2005	16	16	16	16	16	16	16	16	17	17	1	13
2006	16	16	16	16	16	16	16	16	17	14	1	13
2007	16	16	16	16	16	16	16	16	16	15	1	15
2008	17	17	17	17	16	17	17	17	17	15	1	13
2009	15	16	16	17	16	16	16	16	16	17	1	12
2010	18	18	18	18	16	17	18	17	18	15	2	15
2011	17	17	17	17	16	17	17	17	17	15	1	15
2012	18	18	18	15	15	16	17	18	18	18	1	14
Bank Vegetative Protection												
2005	11	12	15	15	15	15	18	16	17	11	2	8
2006	11	13	16	16	14	16	16	16	17	10	2	8
2007	12	12	16	16	14	14	16	14	16	10	2	10
2008	14	14	17	15	15	16	13	12	17	10	2	8
2009	20	18	18	20	16	13	19	15	14	13	1	20
2010	18	18	17	17	14	18	16	16	18	14	2	15
2011	17	16	15	17	14	13	15	16	16	13	2	16
2012	17	16	14	14	17	17	16	16	17	13	2	17
Condition Of Banks												
2005	18	18	14	18	18	14	16	17	16	8	20	18
2006	18	13	14	18	18	14	16	17	15	16	20	18
2007	18	14	15	18	13	14	15	16	14	15	20	16
2008	18	17	16	16	18	14	15	16	18	16	20	18
2009	17	12	13	11	17	10	10	18	15	11	20	5
2010	18	17	16	16	15	17	14	17	18	15	20	18
2011	18	16	15	16	16	14	15	16	16	16	20	14
2012	16	17	15	17	18	15	14	16	16	18	20	18
Riparian Vegetative Zone												
2005	7	7	9	12	6	6	9	11	10	9	2	2
2006	7	7	10	14	6	6	8	11	10	6	2	2
2007	7	4	8	15	6	6	11	11	10	6	2	2
2008	8	9	12	15	6	6	7	15	12	7	2	2
2009	2	4	8	13	5	4	7	10	16	16	5	4
2010	10	7	10	15	10	6	8	15	16	3	2	6
2011	4	8	8	12	8	4	9	10	7	4	2	7
2012	14	14	8	17	10	12	14	18	19	11	2	4

Scoring Color Code

Score	Category	Color Code
16 to 20	optimal	
11 to 15	suboptinal	
6 to 10	marginal	
0 to 5	poor	

iii. Hydrologic Model

No work was performed on a hydraulic assessment for Moores Run during January 2011 through June 2012.

2. Stormwater Management Assessment

This section of the permit requires the City to evaluate the effectiveness of stream restoration as a BMP focusing on the Stony Run Projects. SWMD continued to collect biological and chemical monitoring data in Stony Run during January 2011 through June 2012. A discussion of these results can be found in Section F2, "Restoration Monitoring".

H. Program Funding

During the reporting period, operations and capital projects related to stormwater were primarily funded by the General Fund. No funding was provided for capital projects in Fiscal Year 2011, but approximately $12 M in county transportation bonds were made available in Fiscal Year 2012 for capital projects to be completed by 2014. The funded capital projects included infrastructure rehabilitation in addition to restoration projects. During Fiscal Year 2012, three major infrastructure failures (Cathedral Street, I-83, and Monument Street) occurred which required the diversion of capital funding infrastructure repair. The average annual budget (normalized for the 18-month reporting period) is provided in Table H.1 below.

Table H.1 Annual Budget (rounded to nearest $100)

Permit Condition	**Budget**
C. Source Identification	$100,100
D. Management Programs	
1. Stormwater Management	$341,900
2. Erosion and Sediment	$359,000
3. Illicit Discharge	$1,416,300
4. Property Management	$24,500
5. Road Maintenance	
Street Sweeping	$3,576,983
Inlet Cleaning	$2,353,438
6. Public Education	$138,130
E. Watershed Assessment & Planning	$40,513
F. Watershed Restoration	$845,900
G. Assessment of Controls	$172,800
Sub-Total	**$9,369,564**
Other SWMD and UMD expenses	$3,500,000
Grand Total	**$12,869,564**